FLIGHT
The AIRCRAFT ENGINEER AND AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor: STANLEY SPOONER

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list—

1930

- **Mar. 1** .... **Model Aircraft Club display, Wimbledon Common.**
- **Mar. 4** .... **"Winged Flight." By Mr. J. D. Batten, before S.M.A.E.**
- **Mar. 5** .... **"Air Co-Operation with Mechanised Forces." Lecture by Wing-Com. T. L. Leigh-Mallory before Royal United Service Institute.**
- **Mar. 6** .... **"Resistance of Air-Cooled Engines and the Townend Ring." Lecture by Maj. F. M. Green and Mr. H. C. H. Townend before R.Ae.S.**
- **Mar. 10** .... **"Air Transport." Lecture by Herr M. Wronsky before R.Ae.S.**
- **Mar. 22** .... **Inter-Services Rugby. R.A.F. v. Army at Twickenham.**
- **Mar. 26** .... **Royal Aero Club House Dinner, and Annual General Meeting.**
- **Mar. 27** .... **British Gliding Association Inaugural Meeting.**
- **April 3** .... **"Operation of the Aero-Postale Service in Europe." Lecture by M. P. Grimault before R.Ae.S.**
- **April 19** .... **Leicester Flying Meeting.**
- **May 31** .... **City of Bristol Air Pageant.**
- **June 9** .... **Northampton Flying Meeting.**
- **June 10—15** **F.A.I. Annual Conference, Paris.**

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The Index for Vol. XXI of "Flight" (January to December, 1929) is now ready, and can be obtained from the Publishers, 36, Great Queen Street, Kingsway, W.C.2. Price 1s. per copy (1s. 1d. post free).

Copies of this Index were included free to all Annual Subscribers in "Flight" issue of February 14, 1930.

EDITORIAL COMMENT

LAST week we published a summary of the Rules and Regulations which will govern the International Touring Competition that is to start from Berlin on July 20 next. The booklet containing the regulations did not arrive in time to permit of a thorough examination being made, and all that could be done in the time available was to translate from the original French text the summary of the regulations, which we published last week. It has now been possible to examine the regulations a little more closely, and if our interpretation of them is correct, it is not difficult to find several obscure points. The regulations were submitted to the F.A.I., and presumably passed by that body, at the meeting held on January 17, 1930. Obviously, therefore, the regulations have become "law," and cannot now be altered, although it would appear that there is a good deal of room for improvement, unless, of course, the meaning intended with certain passages is different from that which one would naturally ascribe to them.

A Puzzle

One point to which it would seem that attention might with advantage have been drawn is that of the system adopted for the award of points in the speed test. The regulations state (we are basing these remarks on the French version, but the German text, as given in *Flugsport* of February 19, 1930, bears it out) that the speed with which competitors will be credited will be the total distance of the circuit divided

by the total time taken for the Circuit of Europe (less the time spent in the compulsory controls), and that for speed, a maximum of 195 points will be awarded.

The award of marks for speed is to be made on a sliding scale, machines averaging less than 80 km. (50 m.p.h.) being disqualified. The regulations state that machines doing between 80 and 90 km. will not be awarded any points. Machines doing from 91 to 135 km. will be awarded 3 points per km. Those doing from 136 to 155 km./h. will be awarded 2 points per km./h., and those doing from 156 to 175 km./h. will be awarded 1 point for each km./h.

First, it is necessary to bear in mind that the maximum points to be awarded is 195. Now, if the award is being made on "absolute" speed (*i.e.*, on the average speed actually attained in the Circuit of Europe), a machine with an average speed of 91 km./h. would receive 3 × 91, or 273 points. The maximum is 195 points. A machine doing 135 km./h. would receive 3 × 135, or 405 points, but the maximum is 195 points. A machine in the second speed class doing, say, 150 km./h. would receive 2 × 150, or 300 points, but the maximum is 195.

One is, therefore, forced to the conclusion that what is intended, although we have failed to find any mention in either the French or the German text, is that the basis of award is to be not the "absolute" speed but the number of km./h. by which a machine exceeds 90 km./h. If that basis is assumed, one is still left with a sense of bewilderment concerning what is intended, for it is found that a machine with a speed of 135 km./h. would receive 3 (135-90) or 135 points. A machine in the next speed class would receive, for 136 km./h. 2 (136-90) or 92 points. For the maximum in this division, *i.e.*, 155 km./h. the points awarded would be 2 (155-90) or 130 points. Finally, the most that could be gained by a machine in the fastest speed division at 175 km./h., would be (175-90), or 85 points.

If "absolute" speed is to be the basis, there would seem to be nothing to be gained by flying faster than 91 km./h. (50·6 m.p.h.), as that figure and all above it would be awarded more than the stipulated maximum of 195 points. On the other hand, if what is meant is the number of kilometres per hour above 90 km./h., then the best speed for point-gaining purposes is found to be 135 km./h. (82·9 m.p.h.). Why those responsible for drawing up the regulations should consider this a particularly meritorious cruising speed around Europe is not clear. The most likely explanation is that the award of points is cumulative, but if so the fact ought to have been stated.

In the take-off and alighting tests similar (apparent) anomalies are found. For example, it appears that the competitor who exceeds the best take-off the most, gets the greatest number of marks. An official statement from the Royal Aero Club would be welcomed, and might explain quite simply these apparently illogical regulations.

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There are three systems under which air services are helped by Governments in the British Empire. One is by the grant of a subsidy. The second is by the grant of a mail contract by the Post Office.

Subsidy or Mail Contract?

The third is the operation of an airway by the Government itself. The first of these systems is the one adopted by His Majesty's Governments in Great Britain, in Australia, and in South Africa. The second system is favoured in Canada. The third occurs only in India, though in 1925 the South African Government ran an experimental air service between Capetown and Durban for three months.

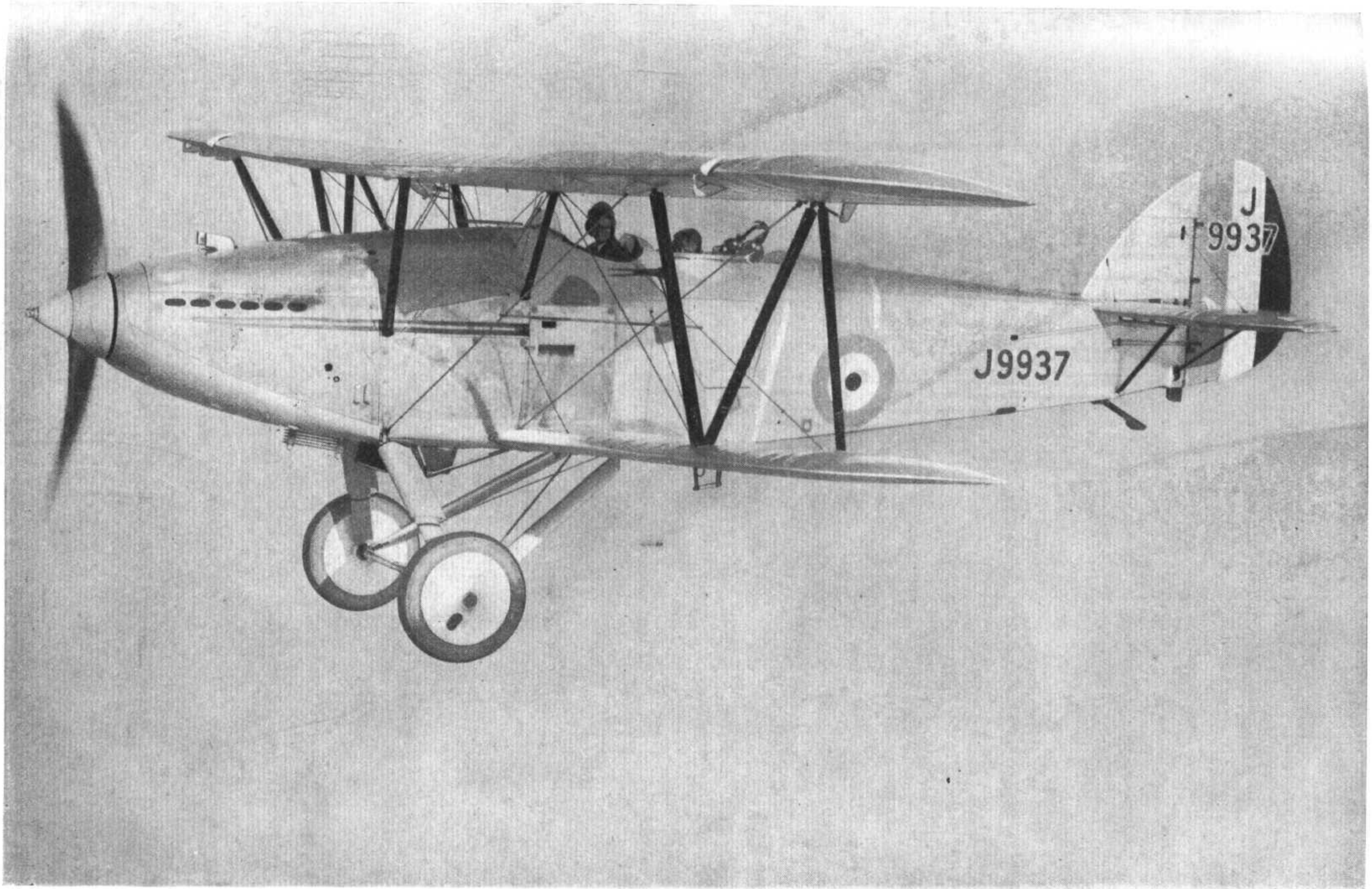
At the moment we hardly feel prepared to approve or condemn the Government of India for running its own air service. The Indian State railways work well, and the State airway may well be equally successful. In Australia the subsidised airways are an unqualified success. Union Airways, Ltd., in South Africa is too young to afford data for comment. The Canadian method, however, is very interesting.

Mail contracts have certain advantages over Government subsidies. An excellent example of their working is afforded by the P. & O. S.S. Co. A mail contract is both generous and rigorous. It is so profitable that it pays the contractor to use only craft with an ample margin of safety and speed. On the other hand, failures are visited with very heavy cash penalties. We should like to see this system applied more widely to airlines. It would certainly affect the design, and it would lead to laying far less stress upon the pay-load factor and far more upon absolute reliability. If the multi-engine principle is considered the best way to obtain reliability, then the conditions of the mail contract would permit no half measures in applying this principle. One engine would have to be really and truly superfluous to the power needed to carry full load. The contract would pay for the weight of that extra engine. Results, and only results, would be the criterion. A forced landing which made the mails late would be so heavily penalised that no contractor would risk it.

Aeronautical folk are far too fond of talking about an efficiency of 99%, as if that were very creditable. If three flights a day were scheduled (not an extravagant number in a highly developed community) that would mean one failure nearly every month. No Postmaster General in the world would tolerate ten or eleven failures per annum. Contractors and designers would have to achieve a far higher figure of reliability than that; and, given a sufficiently handsome contract, this could be done. A mail contract would also be likely to produce special types of mail aeroplanes, equally reliable by day and by night, in which carriage of mails, rather than accommodation of passengers, would be the main or the only consideration. The Government of Northern Rhodesia, by granting a contract for an air survey, has evoked a design of survey aeroplane in which pay-load has been largely sacrificed to reliability. A mail contract is calculated to have a similar effect. It lays down what the aeroplane has to do, not how it must do it, and leaves the rest to the experts. The result ought very greatly to enhance the reputation of aircraft as a vehicle of transport.

Aviation Old Timers

WHILE there are a number of the early British Air Pioneers still with us, there are some with whom we have lost touch, and whose present activities and whereabouts are unknown to us. We are anxious to possess a record of all living aviation "Old Timers" and would, therefore, greatly appreciate a word from any who—so to speak, are "behind the bushel." Some, of course, are taking an active part in business life of today, and their names are prominent in the public eye.

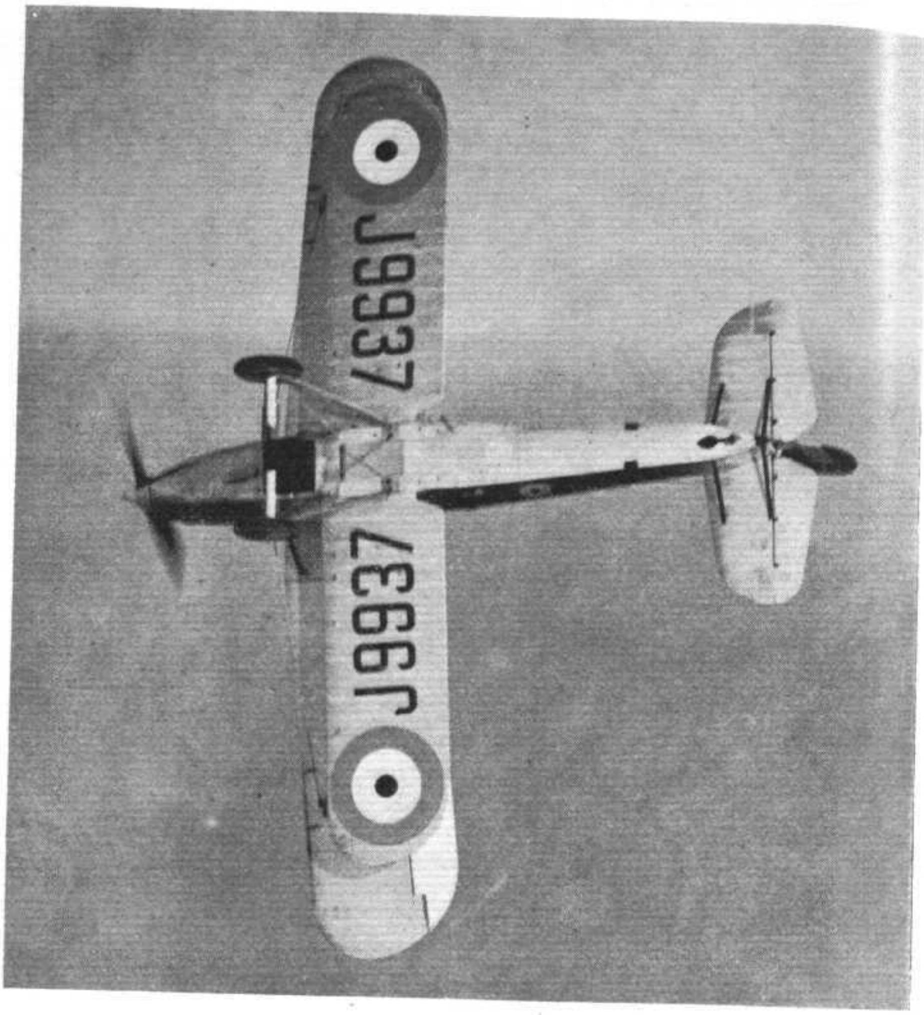


PERFORMANCE: The Hawker "Hart," with Rolls-Royce F type engine, is a single-engined bomber with an extremely high performance. (See next page.)
(FLIGHT *Photo.*)

HAWKER "HART"

THOSE who have had the opportunity to watch developments during the last two or three years cannot have failed to notice the way in which the Hawker company has, under the joint managing directorship of Mr. Sopwith and Mr. Sigrist, produced consistently better and better aircraft The "Horsley" was a good machine in its day, and is still well liked by R.A.F. pilots. The "Hart," illustrated in the accompanying FLIGHT Photographs secured recently at a height of several thousand feet above the fog and smoke, is a modern, high-performance single-engined bomber, fitted with Rolls-Royce "F" type engine. The small frontal area of this engine has enabled Mr. Sydney Camm, Hawker's chief designer, to produce a machine with a fuselage of extremely smooth contour and low drag. The efficiency of this machine may be gathered from the fact that the speed at 6,000 ft. is 176 m.p.h., and that this height is reached in 5 minutes.

Without giving detailed figures of weight, etc., it is of interest to point out that the ratio of gross weight to tare weight is about 1·6, so that Mr. Camm has, in addition to producing a very pretty and aerodynamically efficient machine, designed a structure of low weight. Although designed as a service machine, the "Hart" might well, with minor modifications, be used as a high-speed mailplane.



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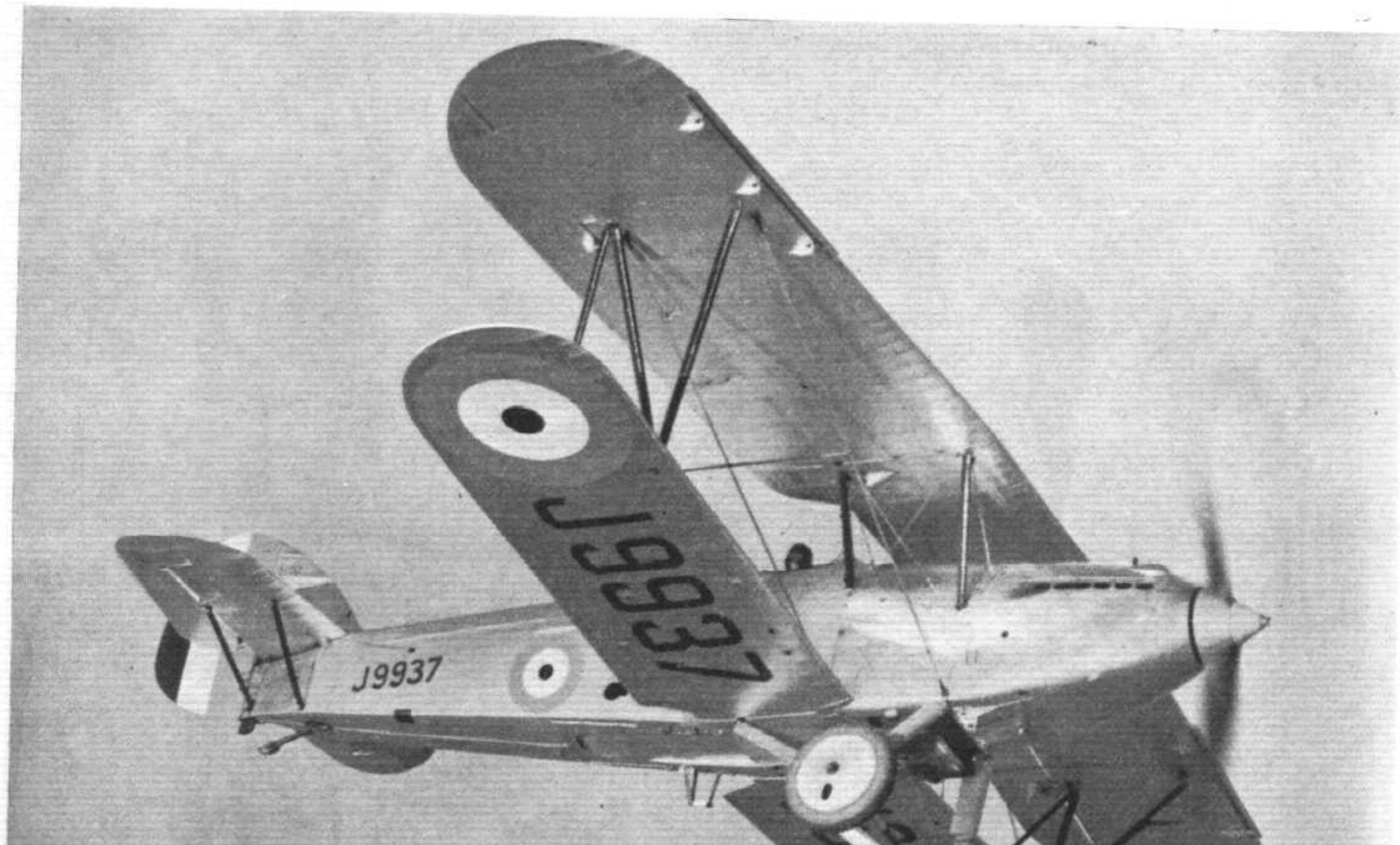


PRIVATE FLYING
AND CLUB NEWS

THE GUILD OF AIR PILOTS AND AIR NAVIGATORS OF THE BRITISH EMPIRE has just decided on a design for the Loving Cup which Lord Wakefield has so generously given them as a start for their "plate," and as will be seen this is a design that is in every way pleasing. Much controversy has been raised by the order which necessitates a pilot sending for a custom's official before releasing his passengers to continue their journey in the case of a forced landing, and it is the aim of the Guild to thoroughly investigate all aspects of such questions as these; the suggestion has been put forward that in such a case the pilot might be empowered to "sign out" the passengers' luggage himself, but whether the Board of Customs and Excise would take kindly to this delegation of their powers seems very much open to doubt. The Guild are anxious to get into touch with all "old timers" and would be very glad to have the addresses of any if they would send them to the Secretary, Mr. Laurence Wingfield, 61, Cheapside, E.C.2.

THE HALTON AERO CLUB have several lectures arranged during March, the first of which will be Wind Tunnel Application to Slotted Wings by Mr. C. D. Russell of Handley Page, Ltd., The Application of Diesel Engines to Aircraft by A. Chorlton, and Metal Construction of Aircraft by A. A. Jacobs. A separate Gliding section has been formed and will be affiliated to the British Gliding Association (B.G.A.). An excursion was arranged to the Gliding lecture given by Dr. Georgii before the R.Ae.S. on February 19. The Sparrow is being reconditioned with the help of A.A. volunteers, by Mr. Gamon. Mr. F. J. Sanger has been elected Assistant Hon. Secretary. A silver and a gold medal will be awarded annually for the best lectures by A.A's.

THE DELHI FLYING CLUB has increased its membership during 1929 from 122 to 204 and its pupils have gained 16 "A" licences. The Club headquarters have now been shifted to the new civil aerodrome at Safdarjung, New Delhi, and it is hoped that the new hangar will be ready by the end of March next. The average cost of training works out at Rs. 337.

THE BROOKLANDS SCHOOL OF FLYING are striking a new note on Sunday, March 2, at Brooklands. They are not having just an ordinary well-run flying "at home," but are asking all private owners to come and meet the cast of "Silver Wings," the show now running at the Dominion Theatre. It is announced that parachute descents and aerobatics will form part of the attraction, but whether "Silver Wings" will be aerobating in their own machine we are, unfortunately, not told! 2.30 p.m. is the zero hour, and tea and light refreshments will be served. The Brooklands School generally manage to be original, and the afternoon on Sunday should, if it carries on the standard set last year on Tagg's Island, be thoroughly enjoyable.

THE AIRCRAFT CLUB, HARROGATE, are finding a rapidly growing interest in gliding in their district and consequently their membership is increasing daily. They are at present building a glider which should be in the air before very long now.

THE HOUSEHOLD BRIGADE FLYING CLUB will hold their annual competition for the "Guyan Maddocks" Cup" at Heston Air Park on Saturday, June 21, at 3 p.m. All private owners are particularly welcome

THE CAPETOWN FLYING CLUB had bad luck during January, when Sir Alan Cobham visited the Wynberg Aerodrome to give joy-rides, the proceeds of which were to help the club funds. As the wind got more and more gusty flying had to be abandoned, and to aggravate their troubles a gust caught the wing of a machine flown by the club's pilot, Capt. N. R. Cook, and turned the machine over so that a wing and the airscrew were damaged.

THE SHEFFIELD FLYING CLUB, and also the Southport Aero Club and the Derby Aero Club, are all looking for sites upon which to start their initial flying activities, and it seems a great pity that their respective City Councils do not, in some cases, appear eager to help them, for there is no doubt that the establishment of a flourishing flying club is a distinct asset to any town, and the subsequent taxi-operations, should the club cater for such things on its own or join in with N.F.S., can but bring trade and ultimately prosperity.

THE SCHOOL OF PILOTAGE, which is a section of the Swiss Aero Club, has shown great activity recently and the number of flights has risen from 6,442 in 1928, to 11,860 in 1929.

A 1930 MODEL: The latest edition of the Moth III, which should appeal to those pilots who have reached the stage of wishing for something "warm and dry" to fly in.

Grace and Speed : The **Moth III should** certainly **confute** the **critics who think** that **a cabin aircraft** is **synonymous with** lack **of speed, but** whether **the tandem** seating **arrangement will** find **favour will be** an **interesting point** to watch.

THE LANCASHIRE AERO CLUB are forming a glider section and are about to purchase a German glider. Mr. Alan Goodfellow represented the club at the Informal Dinner and Discussion which followed Dr. Georgii's recent lecture on the subject, and following the advice they received as to the best type, it is probable that one of the Prüfling type will be ordered.

BRISBANE is another of the many places which is fast becoming "glider-minded" in the British Empire, and as the result of a recent meeting the Brisbane Glider Club will be formed with its flying ground at Holland Park. The gliding conditions are said to be ideal in this part of Australia, and the possibility of records being set up is being freely discussed.

NATAL is one of the latest States in the Union of South Africa which is forming a flying club, and Vryheid, together with Dundee, is shortly going to cater for those who wish to learn to fly in this part of the world.

THE CEYLON LIGHT AEROPLANE CLUB is still trying hard to get the Government of Ceylon to put up a subsidy in order that a start may be made with flying, but so far they have met with little encouragement and the fact that India is getting well ahead of them does not seem to worry the Government at all.

PHILLIPS AND POWIS, of Reading, report that they have been very busy since the reduction of their flying rates and during the last week have had five machines in service which flew a total of 24 hrs. 35 mins.

BURNLEY now has a School of Flying which has been started by Mr. E. Brown, of 3, Parkerlane, he will use Avro machines for instruction.

THE KARACHI AERO CLUB have an enterprising member in the person of Mr. R. N. Chawla, who, together with his engineer, recently flew his Gipsy-Moth from Karachi to Delhi and back via Montgomery and Utarlai. Mr. Chawla has won prizes for aerobatics and balloon bursting at the Karachi Air Pageants and he hopes to have a try to win the Aga Khan prize for a flight from England to India, if he is allowed to take a passenger.

THE CINQUE PORTS FLYING CLUB will hold their monthly competition for the Ashwell-Cooke and Clayton Rickard Cups at 11.45 a.m., Sunday, March 2. Entry forms can be obtained from the Hon. Sec., 114, High Street, Hythe, Kent. All *bona fide* private owners are welcome to compete and, as the entrance fee is only 5*s*., it is hoped that a large number will turn up.

R.A.C. SERVICE FOR AEROPLANES.—Members and Associate-Members of the R.A.C. owning aeroplanes are now able to avail themselves of a considerable number of the benefits offered by the Club and generally associated with cars and motor-cycles only. The "Get-you-Home" Service operates in the case of a forced landing, the Road Guides are at the disposal of any airman requiring assistance, and the R.A.C. Touring Department has already been requisitioned on a number of occasions for cross-country routes. In a number of cases members carry the R.A.C. badge on their 'planes, special fittings being provided for this purpose. The R.A.C. wishes to make it clear that whilst it has no special department devoted exclusively to aviation, very many of the benefits it offers are applicable to flying, and the Club is prepared to assist in any way possible any of its members who have occasion to require its services whilst "in the air," instead of "on the road."

THE PARKS AIR COLLEGE, which is a division of the Detroit Aircraft Corporation of East St. Louis, Illinois, have found that the Goodyear Air Wheel, which is, in effect, a balloon tyre of very exaggerated proportions, has enabled them to maintain their normal flying schedules during the past few weeks when melting temperatures have made the aerodrome very heavy and muddy. One wonders why these are not tried at certain aerodromes in this country for the same reason!

THE *Scientific American* announced in 1929 a light 'plane contest, and through the generosity of Colonel R. Potter Campbell, President of American Cirrus Engines, Inc., it offered a prize of 500 dols. and gold medal, a silver medal, and a bronze medal for the best three designs of a light two-seater aeroplane. Eighty individuals were interested enough to write in for specifications, and 19 complete designs were finally submitted in the contest.

The contest rules called for a 'plane with the Cirrus Mark III engine, and were :—

(1) The design was to be one which would be most suitable either as a training plane or for private ownership.

(2) Minimum allowed by the Department of Commerce in the way of instruments was required.

(3) The fuel system to provide for five hours at full throttle.

(4) Provision for 50 lbs. of baggage and a baggage compartment.

A LADY OWNER IN AUSTRALIA ; Lady Somers, the wife of the Victorian State Governor, is now the owner of the above Gipsy Moth. She took her "A" licence in England, and is said to be the first woman in the Commonwealth to own her own machine.

(5) Minimum gliding speed of 40 m.p.h. Maximum speed to exceed 95 m.p.h.

(6) No restrictions were placed on the type of design. The fuselage was to be of metal construction, but the wings could have been of wood construction.

(7) Each competitor for the prize was required to submit the following information :—

(*a*) Three views of 'plane and main dimensions and characteristics.

(*b*) Detailed weight estimate.

(*c*) Balance diagram and stability and control considerations.

(*d*) Preliminary performance calculations.

(*e*) Preliminary stress analysis.

(*f*) Drawing showing power-plant installation with fuel system.

(*g*) Drawing showing accommodations for pilot and passenger.

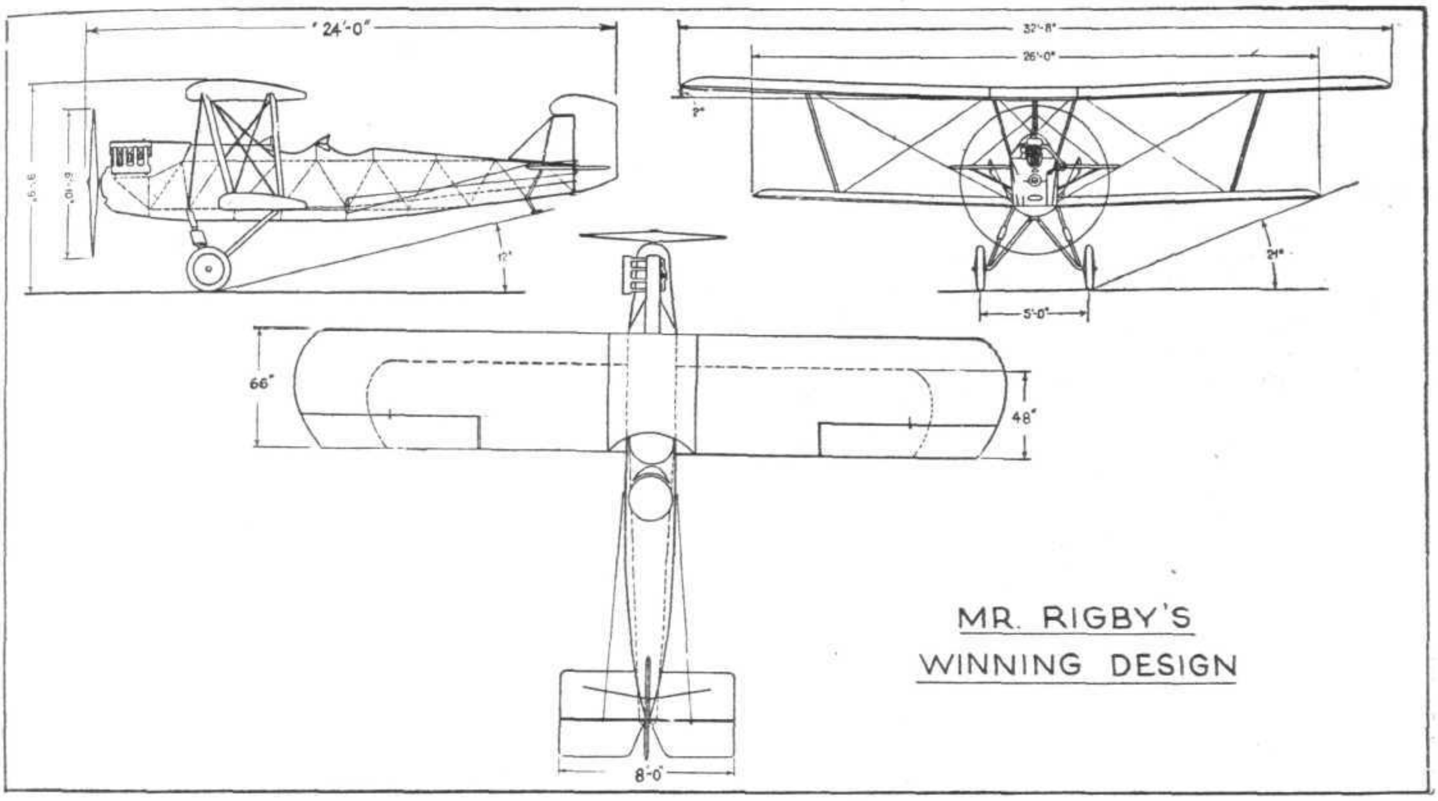
much deliberation chose the design by Private James P. Rigby, 65 Sqdn., Luke Field, T.H., for the prize. He was awarded 125 out of the possible 130 points. Mr. Rigby's 'plane is a tandem biplane with a steel fuselage and wooden wings.

The fuselage is of low-carbon steel (1025) using the full Warren truss and welded joints. The two cockpits are located out beyond the wing, giving good visibility and accessibility. The fuel tanks and the baggage compartment are located forward of the cockpits near the centre of gravity. Thus the designer provided a small movement of the centre of gravity under all possible loading conditions.

The wings are of the conventional wood and fabric type with built-up box spars, pinjointed at the fuselage. Ailerons are used only on the upper wing.

The landing gear is of the split-axle type using disc shock-absorbers and the tail skid using rubber cord.

The tail surfaces are of dural, having an adjustable tail



MR. RIGBY'S WINNING DESIGN

(*h*) Sketches of the structure of the 'plane, wings, fuselage, tail surfaces, landing gear, and controls.

(8) The designs were rated according to :—

(*a*) General suitability of the 'plane for training and private ownership purposes and general excellence of the design	20 pts.
(*b*) Performance	15 ,,
(*c*) Power plant installation	15 ,,
(*d*) Construction and ease of maintenance ..	80 ,,
Total	130 pts.

The judges of the competition were :—Miss Amelia Earhart, representing woman's accomplishment in aviation. Mr. George Palmer Putnam, private 'plane owner. Professor Alexander Klemin, of the Daniel Guggenheim School of Aeronautics, New York University.

A large number of designs were received from every part of the U.S. and England.

The judges found the designs excellent as a whole, and after

plane and fin. The rudder is balanced and all surface controls are of the cable type.

The performance for the machine is as follows :—

Landing speed ..	39 m.p.h.	Stagger ..	18 in.
High speed ..	95 m.p.h.	Gap	60 in.
Climb	693 ft. per min.	Incidence ..	0 deg.
Service ceiling ..	14,500 ft.	Dihedral ..	2 degs.
Absolute ceiling ..	16,500 ft.	Area, upper wing	165 sq. ft.
Endurance ..	5 hours	,, lower wing	88 sq. ft.
The structural specifications :		,, total ..	253 sq. ft.
Type	Biplane	Aileron area (upper)	24 sq. ft.
Span, upper ..	32 8 ft.		
,, lower ..	26 ft.	Area, tail 'plane	16 sq. ft.
Chord, upper ..	66 in.	,, elevator	12 sq. ft.
,, lower ..	48 in.	,, fin ..	4 sq. ft.
Height	9 ft. 9 in.	,, rudder ..	8 sq. ft.
Length ..	24 ft.	Aerofoil U.S.A.27	

Mr. Huep, of Des Moines, Iowa, was awarded the silver medal for his design of a low-wing, full cantilever monoplane with tandem seating accommodation.

Midshipman R. P. Beebe, of U.S. Naval Academy, Annapolis, was awarded the bronze medal for a side-by-side, low-wing, semi-cantilever monoplane.

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A Vacancy

THE Guild of Air Pilots and Air Navigators of the British Empire state that they have received an enquiry from a firm marketing a foreign light aeroplane for a pilot who will be required to demonstrate the machine both here and on the Continent. Pilots wishing for further details should apply to the Secretary of the Guild at 61, Cheapside, E.C.2.

Aircraft Instruments

SHORT and Mason, Ltd., of Walthamstow, E.17, are showing at the British Industries Fair and have a comprehensive exhibit of altimeters for glider type and ordinary types of aircraft, special altimeters for large aeroplanes and airships, altigraphs for recording altitude on charts, meteorographs for scientific investigation in the upper air, incidence gauges for aeroplane constructional purposes, anemometers for ascertaining wind velocities, together with a comprehensive exhibit of various instruments.

Greek Air Attaché

CAPT. PHOCAS has been appointed Naval and Air Attaché at the Greek Legation in London.

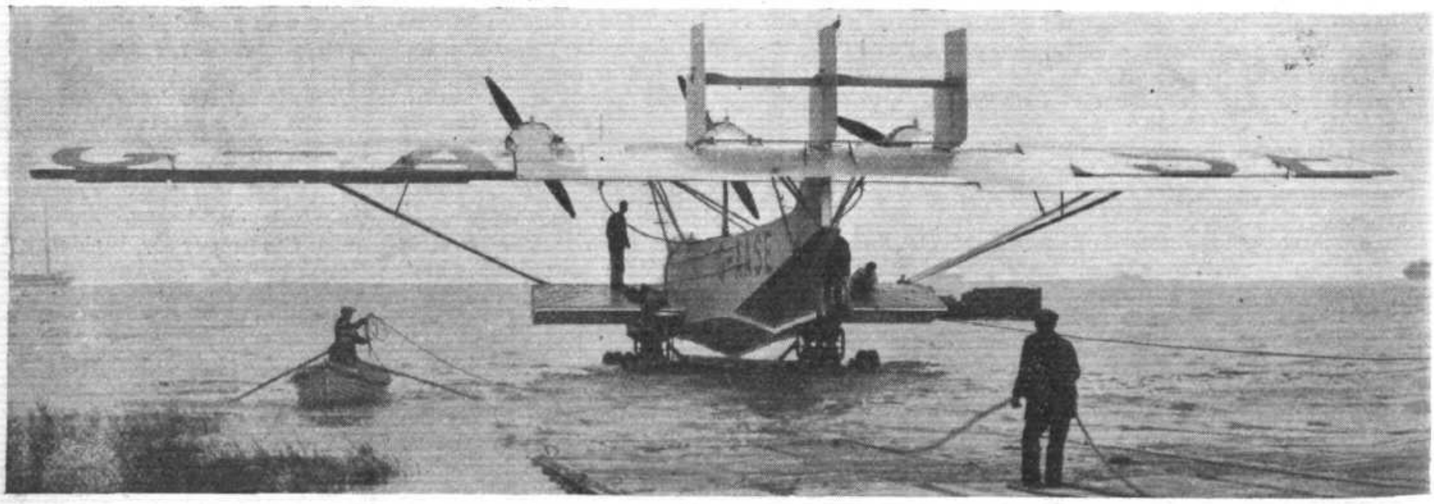
Commdr. Kenworthy in Air Mishap

COMMDR. KENWORTHY, M.P., who was travelling back to England from India by air, reports that his machine was damaged in the south of Palestine ; there were no personal injuries, and he is continuing his journey by sea.

AN AIR YACHT DE LUXE

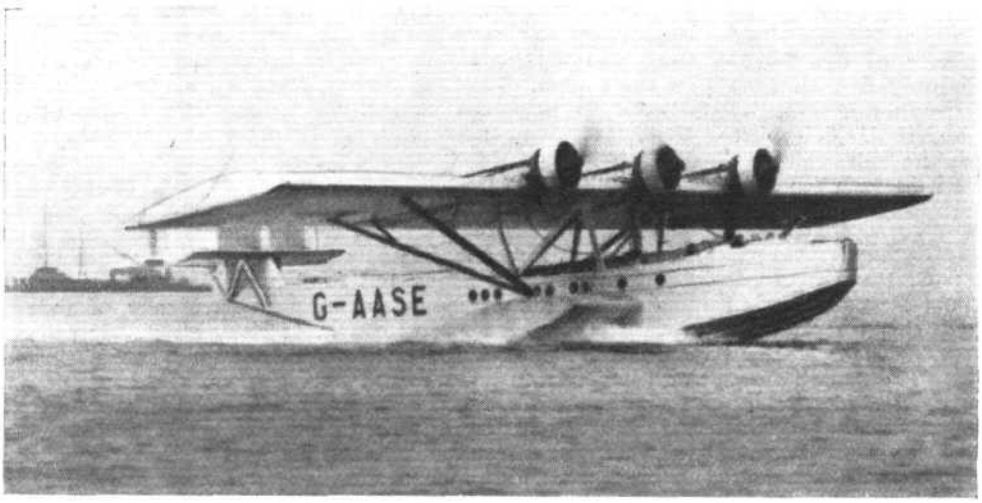
FLYING has not quite reached the prominence of yachting in the affections of wealthy sportsmen. At least not seaplane flying. So far we have had no Tommy Lipton flying in his own air yacht across the Atlantic to challenge an American defender. But a very good beginning towards that desirable state of affairs was made a couple of years ago, when the Hon. A. E. Guinness bought from the Supermarine Aviation Works the large three-engined flying-boat "Solent." On that machine Mr. Guinness has done a great deal of flying, and has used the "Solent," in addition to shorter cruises on the South Coast, for flights between England and his Irish castle, and for cruises to the Irish lakes. Mr. Guinness is a man who dislikes publicity, and so his use of a flying-boat "air yacht" during the past two years has been much less heard of than could have been desired. A few people directly interested in aviation have known for several months that Mr. Guinness had placed an order with Supermarine's for a new flying-boat, to be used by him as others use their surface yachts; but a promise of secrecy was extracted from those of us who knew of this machine, and not until now has it been possible

The New Supermarine Air Yacht: The three Armstrong-Siddeley geared "Jaguar" engines are mounted direct on the wing. The view below shows the usefulness of the lower wing stumps as gangway platforms.



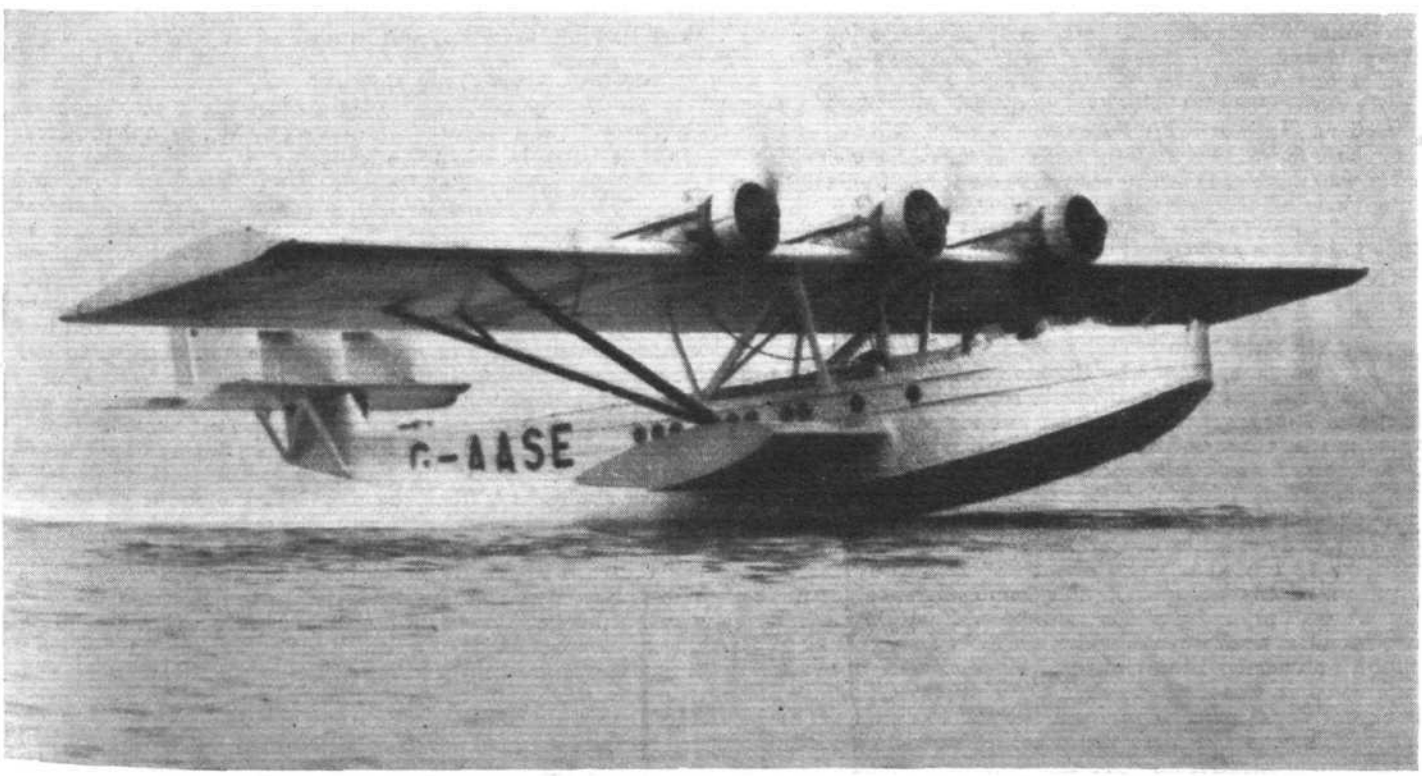
to refer to it in print. Mr. Guinness has now, fortunately, been persuaded to agree to a few particulars and photographs being published, so that the outside world may learn a little of the rather unusual machine which Supermarine's have designed and built for him.

The new Supermarine "Air Yacht" is of a design differing very materially from all previous Supermarine flying-boats. To begin with, it is a monoplane, the first monoplane built by this firm, apart from the converted "Sparrow" light 'plane. Then, instead of outboard wing floats it has short wing stumps growing out of the hull sides, after the fashion of Dornier flying-boats. This arrangement was almost a logical outcome of the decision to use the monoplane type of wing, as the struts supporting outboard floats from the wings would have had to be rather long. Moreover, the lower wing stumps do undoubtedly, whatever may be their merits in a rough sea, provide useful platforms for emplaning and disemplaning passengers with the aid of a launch.



The reproductions of the photographs do not show it, but in the original photographs it can be seen that Mr. Mitchell, Supermarine's chief designer, has gone a step farther than Dr. Dornier (this is not intended as a pun) by providing his wing stumps with shallow steps, so as to extract from them hydrodynamic lift when running, in addition to displacement lift or buoyancy when at rest. It will be interesting to see how this arrangement works in practice. The photographs of the machine running seem to indicate quite exceptional cleanness, but we have not yet had an opportunity of seeing the machine take off, and so do not know whether this absence of thrown-up spray is maintained throughout the whole take-off period.

The wing is supported on struts from the hull, and is braced outboard by sloping Vee struts attached to the lower wing stumps. The three Armstrong-Siddeley geared "Jaguar" engines are mounted direct on the wing and



THREE STAGES IN THE TAKE-OFF OF THE SUPERMARINE AIR YACHT : In the upper photograph the machine is running slowly. In the centre the machine is gathering way, and finally in the lower picture the boat is on its step. Clean running characterises all three stages.

carefully faired, while Townend rings are fitted so as to reduce drag. The structure of the hull and wings is of Duralumin, while highly-stressed fittings are of stainless steel. The wing covering is fabric.

The fuel and oil tanks (sufficient for a range of 2,000 miles if crew only carried) are housed in the wing, a position which will scarcely allow direct gravity feed to be used, but this is a feature common to most monoplane flying-boats. Normally, the machine will not be flown with full tanks, and as a rule the load will be made up of a crew of 3, 6 passengers, and an available load for luggage, etc., of 600 lbs. With this load and fuel to make up a gross weight of 10½ tons, the machine has a range of some 650 miles. The top speed is about 120 m.p.h., and the cruising speed 100 m.p.h. The overall length is 66 ft. 6 in., and the wing span 92 ft.

Below decks the owner's accommodation is very spacious for a flying-boat, with a saloon and cabins, with dressing tables, bookcases, wardrobes, etc. The crew's quarters are forward, under the cockpit. Electric lighting is provided, and the ventilation system includes admission of hot or cold air as required. The galley is fully equipped with oil cooking apparatus so that meals can be prepared on board. Touch with the shore is maintained by means of wireless, both transmitting and receiving apparatus being installed.

AIRISMS FROM THE FOUR WINDS

R.A.F. Flight to the Cape

THE R.A.F. flight by four Fairey IIIF biplanes of No. 14 Bomber Squadron from Cairo to Cape Town and back was concluded, according to schedule, on February 24. The four machines, in company with four machines of the South African Air Force, arrived at Heliopolis only five minutes late. Air-Commodore Board was in command, and the four Fairey-Napier machines accomplished the 11,000 miles without any mechanical trouble. This is the fifth successive year the flight has been carried out, and on each occasion the same type British aircraft and engines have been employed with the same successful results.

The Flight to Australia

FLYING OFFICERS H. L. PIPER AND C. KAY, who left Croydon for Australia on February 9 in a Desoutter cabin monoplane ("Cirrus Hermes"), reached Bushire on February 18, but on the following day engine trouble forced them down on the beach near Jask aerodrome. The machine was taken to the latter, where repairs were effected, and on February 21 they proceeded to Karachi. Allahabad was reached on February 23, and the next day they flew to Calcutta and Akyab. On February 25 they left for Rangoon.

The Fairey Survey Machine

THE second Fairey IIIF biplane (Armstrong Siddeley "Jaguar VI") G-AATT, supplied to the Air Survey Co. for their work in the Sudan, is—as previously reported in FLIGHT—being flown to its destination by Mr. R. C. Kemp. Mr. Kemp left Croydon on February 9 and reached Lyons the same day, where he was delayed by fog. He reached Bengazi on February 15, and Cairo the following day, where he stayed a couple of days on business. Proceeding from Cairo on February 19, Khartoum was reached on February 20 and Juba on February 22, thus completing the journey in 8½ flying days.

Back from Africa

FLYING OFFICER H. PRESTON and Mr. E. Mordeon arrived at Hanworth on February 18 from Africa, whence they had flown in company with Miss W. Spooner. The latter was unable, owing to illness, to complete the last stage from Paris at the same time, but flew, as passenger in an Imperial Airways "Argosy," to Croydon the following day. They have been engaged, it will be remembered, in surveying the possibilities of air transport in East Africa on behalf of the Hon. F. E. Guest, who returned to England a few weeks back.

Italian Air Fatalities

AN aeroplane, piloted by Gustavo Cabtaldi and with the Duchess Fiametta Carafa-d'Andria as passenger, crashed at Naples on February 22; both pilot and passenger were killed. Sig. Bottalla, the well-known Italian war pilot, died at Turin on February 24 as the result of injuries received recently in an accident during a trial flight in a light 'plane.

Ben Eielson's Body Found

THE body of Lieut. Carl Ben Eielson was found on February 13 buried in snow about 65 yards away from the wreckage of his aeroplane, and some distance from the spot where the body of his mechanic, Earl Borland, had been found a week before. The death of this gallant pilot will be universally mourned, and especially in the British Empire, as it was he who flew Sir Hubert Wilkins in his Lockheed Vega monoplane from Alaska to Spitzbergen in 1928. This was the first flight from America to Europe across the Arctic Ocean. Wilkins and Eielson had worked together for some two years, and had experienced adventures and misfortunes. On one flight they were forced down on to the ice in a blizzard, and had to abandon their machine and walk back to land. The tramp took them 18 days, and it was only Wilkins's experience of the Arctic which enabled them to win through. Before they left their aeroplane Eielson's fingers were frostbitten from working on the engine. Last November, Eielson flew from Zeller in Alaska to help the ship *Nanuk* which was ice-bound on the coast. Six persons were brought off the ship, and Eielson and Borland were on their way back to it when they evidently crashed, and were both killed. The bodies are to be brought back to civilization as soon as the weather permits.

An Egyptian Aero Club

LEADING Egyptians and foreign residents have formed the Aero Club of Egypt under the presidency of Prince Abbas Halim, the second cousin of King Fuad. It will be affiliated with the Fédération Aéronautique Internationale and will devote itself to the development of aeronautics in Egypt.

Air Survey in Tanganyika

WILSON AIRWAYS are to carry out an aerial survey of the flooded area around Kidete in Tanganyika territory.

French Aircraft Factory Destroyed

THE aircraft factory of the Letord Aviation Co. at Meudon, was destroyed by fire on February 17.

Lady Heath Flies Again

IT is reported from St. Louis that Lady Heath made a flight for the first time since her crash at Cleveland last year.

Italy Beats Light 'Plane Height Record

SIGNOR R. DONATI, in a Fiat AS1 light 'plane, created a new world altitude record for light 'planes (first category) by attaining a height of 22,245 ft. near Rome on February 21, thus beating the previous record of 19,857 ft. by Capt. de Havilland.

The Prince Flies Over Nairobi

THE Prince of Wales made a short flight at Nairobi on February 23 in a Gipsy-Moth piloted by Mr. Campbell Black.

British Aeroplanes in the Hedjaz

ON Monday, February 24, King Faisul of Iraq, and King Ibn Saud of the Hedjaz, met on a British warship in the Persian Gulf and agreed upon an important treaty of friendship and goodwill. After the meeting, King Ibn Saud was interviewed, and declared that Great Britain was worthy of the highest praise for having always endeavoured to make peace between the Arabs. He had already purchased four British aeroplanes, and he said that he had decided to buy four more for his travels throughout Arabia.

"Airplane" v. "Aeroplane"

A CORRESPONDENT in the *Morning Post* protests (Hear, Hear!) against the British Broadcasting Corporation's use of the word "airplane" for "aeroplane," especially, he says, if "we are to look upon the B.B.C. as the fount of English undefiled."

China's American Air Adviser

CAPTAIN FLOYD N. Shumaker, a former U.S. Army flying officer, has been appointed adviser to the Nanking Government Military Bureau of Aviation, which is planning an extensive programme of military air organisation involving a proposed expenditure of several million American dollars as a two-year development programme.

Air Vote Surplus

A TREASURY Minute has been issued authorising certain surpluses on the 1928 Air Vote to be applied to meet deficits for the same year. After applying the surpluses to meet the deficits, a net surplus of £158,064 is shown.

AIR TRANSPORT

INDIA'S STATE AIRWAY

IN the Indian Assembly, at New Delhi, last month, some details of the Indian State Airway were given by the Member in charge of Industries and Labour, Sir B. N. Mitra. The weekly service between Karachi and Delhi was opened on December 30, and it was hoped to extend the route on to Calcutta before the end of the present year. A further extension to Rangoon would follow soon after, but it might be necessary to suspend the service to Rangoon during the monsoon of 1931.

The Government understood that it would be possible to purchase an aeroplane suitable for carrying up to 800—1,000 lbs of mail matter for approximately a quarter of the cost of a larger plane capable of carrying from 10 to 12 passengers and mails, and that the maintenance and running costs of such an aeroplane over a given mileage, say from Karachi to Delhi, would be approximately three-quarters of those of a larger aeroplane.

Sir B. N. Mitra added that there was no actual obligation to carry passengers, but the Government had announced that passengers would be carried on the Karachi-Delhi service, and that a schedule of fares had been published. This schedule was published in FLIGHT's issue of February 7. The single fare from Karachi to Delhi is Rs. 150 (£11 5s.). While the type of aeroplane used is the Hercules, it is only natural, and indeed necessary, that passengers should be carried. These remarks of the Member for Industry are, however, very interesting, as they suggest that the Government has in mind the possibility of using a specialised mail 'plane which would not carry passengers. Such a policy would, we believe, be the right one to adopt. A concentration of effort on getting mails quickly across India would be the best way to make use of aircraft, at least as a beginning. The service to the community would be the maximum, and, moreover, success in this effort would instil confidence in air transport when the time came to branch out into a purely passenger service, run side by side with the mail service.

Some further light was thrown on the Government's intentions by a discussion in the Finance Committee. Nearly 40 lakhs (including 6 lakhs for the airway) were allocated for civil flying in next year's budget. A section of the committee were afraid that Indians would not be employed in the State Airway, and pressed for the establishment of a school of civil aviation in India. This suggestion was not approved, as it would be unduly expensive, and there was no chance of finding employment for all the students of such a school. But eight Indians, it was pointed out, had been sent to Great Britain with State scholarships to study flying. One of these is Mr. Man Mohan Singh, who recently tried to win the Aga Khan prize by flying solo to India. The Chairman of the Finance Committee stated that it might have been cheaper for the Government to have granted a contract to a private firm to run the air line across India; but this might have resulted in excluding Indians from employment on the service. It was in order to make opportunities for the employment of Indians that he had consented to the State operating its own airway. The Government had taken care to engage British pilots to fly the mail aeroplanes on a one-year contract only, and on every flight there would be an Indian as assistant pilot. In a short time, he said, the air service across India would be manned by Indians entirely. At the same time, a larger number of Indians was being trained as mechanics and ground engineers.

With regard to this scheme it may be remarked that it will not be easy to get good British pilots to go to India on a contract for only one year. At present, no Indian pilots have sufficient experience to take charge of mail aeroplanes, and it is doubtful if a year's work as assistant pilot will give them enough experience. Time, however, should produce a sufficiency of good Indian pilots. The provision of really reliable ground engineers and mechanics, on whom of course the success of the service depends, is a very much more doubtful prospect.

ENGLAND–INDIA AIR SERVICE
Temporary Time Table Issued by Imperial Airways

GREECE-EGYPT-INDIA — READ DOWN — * By Pullman Express — **INDIA-EGYPT-GREECE** — READ UP

GMT	LST	DAY				DAY	LST	GMT
03.30	05.30	Wed.	dep	ATHENS, Acropole Palace Hotel	arr			
04.30	06.30	,,	dep	ATHENS, Phaleron Bay Airport	arr	Sat.	15.15	13.15
07.30	09.30	,,	arr	CRETE, Mirabella	dep	,,	12.15	10.15
08.30	10.30	,,	dep	,, ,, ...	arr	,,	11.15	09.15
13.30	15.30	,,	arr	ALEXANDRIA (Harbour)	dep	,,	06.15	04.15
*	19.00	,,	dep	,, (Station)	arr	Fri.	22.50	*
*	22.15	,,	arr	CAIRO (Station)	dep	,,	19.30	*
03.00	05.00	Thur.	dep	,, (Heliopolis Aerodrome)	arr	,,	16.30	14.30
05.30	07.30	,,	arr	GAZA	dep	,,	14.15	12.15
06.15	08.15	,,	dep	,, ...	arr	,,	13.30	11.30
14.15	17.15	,,	arr	BAGHDAD	dep	,,	06.00	03.00
03.00	06.00	Fri.	dep	,, ...	arr	Thur.	14.45	11.45
06.00	09.00	,,	arr	BASRA	dep	,,	11.15	08.15
06.45	09.45	,,	dep	,, ...	arr	,,	10.20	07.20
09.25	12.45	,,	arr	BUSHIRE	dep	,,	08.00	04.40
03.40	07.00	Sat.	dep	,, ...	arr	Wed.	14.50	11.30
07.30	11.25	,,	arr	LINGEH	dep	,,	11.35	07.40
08.15	12.10	,,	dep	,, ...	arr	,,	10.50	06.55
10.35	14.30	,,	arr	JASK	dep	,,	08.30	04.35
02.05	06.00	Sun.	dep	,, ...	arr	Tues.	16.55	13.00
05.35	11.05	,,	arr	GWADAR	dep	,,	15.00	09.30
06.20	11.50	,,	dep	,, ...	arr	,,	14.00	08.30
10.00	15.30	,,	arr	KARACHI	dep	,,	10.00	04.30
10.30	16.00	,,	dep	,, ...	arr	Mon.	16.30	11.00
11.30	17.00	,,	arr	HYDERABAD	dep	,,	—	—
01.30	07.00	Mon.	dep	,, ...	arr	,,	—	—
05.30	11.00	,,	arr	JODHPUR	dep	,,	12.00	06.30
06.30	12.00	,,	dep	,, ...	arr	,,	11.00	05.30
10.00	15.30	,,	arr	DELHI	dep	,,	07.30	02.00

Note.—

1. The outward connection from London and Paris to India is made by the Simplon Orient Express which leaves Victoria on Saturdays at 11.20 and the Gare de Lyon on Saturdays at 20.50, arriving at Athens on Tuesday at 18.59.

2. The inward connection from India to Paris and London is made by the Simplon Orient Express which leaves Athens on Sundays at 11.40 and arrives in Paris on Wednesday at 08.22 and thence by air to London.

Passengers desirous of using these connections may have their through passage booked and every arrangement made for their convenience by Imperial Airways.

Canada's Future in Commercial Aviation

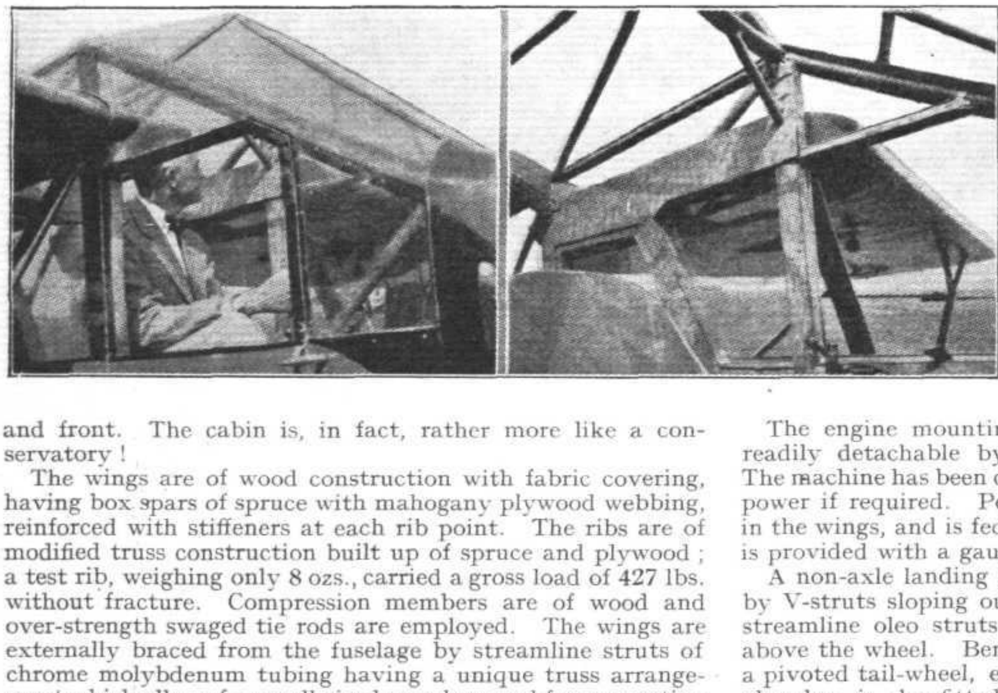
THE HON. PETER VENOIT, Postmaster-General of Canada, in an address given at Montreal, expressed the opinion that in a very few years Canada will be the world centre for commercial aviation. Geographically her position is such that the shortest air routes from Europe must pass over Canadian territory, and close to large Canadian centres of population.

The Postmaster-General also took occasion to announce a contemplated American air mail service through Fargo, North Dakota, to Winnipeg, to link up with Canadian air services to the Pacific Coast. This will be an important link in the distribution of mail throughout the North American Continent, and is additional evidence of the importance Canada's service assumes in the eyes of her American neighbours.

THE BERLINER-JOYCE COMMERCIAL MONOPLANE

A SHORT while back flight tests were carried out with a new commercial cabin aeroplane produced by the Berliner-Joyce Aircraft Corporation of Baltimore, U.S.A., and designed primarily to incorporate a new wing arrangement, giving greatly improved range of visibility for machines of this type, *i.e.*, totally enclosed.

The B-J machine is a two-place high-wing—or, perhaps one should say, " not-so-high-wing "—monoplane equipped with a Kinner 113 h.p. 5-cyl. radial air-cooled engine. Improved vision has been obtained, in the first place, by mounting the wing a little below the top of the fuselage, level with the pilot's eyes. The wings are also cut away at the roots, so that, with a slight movement of his head, the pilot is able to obtain a view in all directions. Secondly, large windows are provided all round the cabin, at the top as well as the sides and front. The cabin is, in fact, rather more like a conservatory!



The Berliner-Joyce Commercial monoplane, the main feature of which is the good visibility obtained by the arrangement of the wings in relation to the cabin. This may be seen from the exterior and interior views of the cabin in the lower picture.

The wings are of wood construction with fabric covering, having box spars of spruce with mahogany plywood webbing, reinforced with stiffeners at each rib point. The ribs are of modified truss construction built up of spruce and plywood; a test rib, weighing only 8 ozs., carried a gross load of 427 lbs. without fracture. Compression members are of wood and over-strength swaged tie rods are employed. The wings are externally braced from the fuselage by streamline struts of chrome molybdenum tubing having a unique truss arrangement which allows for small-sized members and for supporting the spars at multiple points, thereby reducing concentrated spar stresses.

All wing fittings are of steel, the spars being reinforced at fitting points. Forward of the front spar a covering of sheet duralumin extends top and bottom from the spruce leading edge back to the spar, so that this portion of the wing is practically of tubular construction. The tail surfaces, of ample proportions and high aspect ratio, are of steel tube, fabric covered, and are rigidly braced by streamline struts. Friese type ailerons are employed, and the horizontal stabiliser is adjustable during flight from the pilot's seat.

The fuselage is built up of welded c-m steel tubing throughout on the Warren truss system, eliminating the use of wire bracing. In the vicinity of the cabin the fuselage is of generous dimensions, allowing freedom of movement and easy entrance and exit by way of two large doors. Forward, side and door windows are of safety glass, and the side windows can be opened. Both seats are removable, and provision is made for seat-pack parachutes. A luggage compartment is provided behind the rear seat. Dual control is fitted, the rear one being removable when not required.

The engine mounting is of simple rugged design and is readily detachable by means of removable tapered pins. The machine has been designed to take engines of higher horsepower if required. Petrol is carried in two 15-gallon tanks in the wings, and is fed to the engine by gravity. Each tank is provided with a gauge, visible from the pilot's seat.

A non-axle landing gear is fitted, the wheels being carried by V-struts sloping out from the fuselage and connected to streamline oleo struts attached to the wing struts directly above the wheel. Bendix wheels and brakes are used, while a pivoted tail-wheel, equipped with pneumatic tyre and oleo absorber, is also fitted.

The actual performance of the B-J commercial monoplane, with full load, obtained with calibrated instruments and data reduced to N.A.C.A. Standard Atmosphere, is as follows:—

High speed, 150 m.p.h.; stalling speed, 49 m.p.h.; climb, 600 ft. per min.; service ceiling, 13,000 ft.; absolute ceiling, 15,000 ft.

Colonial Airways' Successful Year

PASSENGER and mail 'planes of the Colonial Airways System flew more than one million miles and carried approximately 10,000 passengers and 400,000 lbs. of mail between New York and Boston, New York and Montreal and Albany, Toronto and Cleveland during 1929. The year's operation figures show that a total of 5,971 persons were carried on the passenger 'planes of Colonial Air Transport and Canadian Colonial Airways during the year, an increase of approximately 1,300 per cent. over 1928. Of this number, 4,978 were passengers on the New York to Boston service, inaugurated on April 15. In addition, 4,872 persons were carried on short sightseeing flights and special trips, making a total of 9,982 carried in Colonial 'planes during the year.

Colonial Air Transport and Colonial Western Airways mail increased over 100 per cent. A substantial mail increase was also shown by Canadian Colonial Airways, which began operation in October of 1928. Airmail pilots on the three lines carried a total of 388,536 lbs. of mail in 1929 as compared with 144,167 during 1928. From January 1 until November 30, the company's 'planes flew a total of 952,699 miles.

Thirty-one 'planes are now in active use over the system's lines, as compared with 19 used during 1928. With the installation of beacons over the Colonial Western route between Albany and Cleveland, improved night mail service will be inaugurated. When this schedule is put into effect Colonial 'planes will be in operation every hour of the day and night.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

February 28, 1930

CONTENTS

A COMPARISON OF LATERAL CONTROL METHODS.

By G. C. D. Russell, A.F.R.Ae.S.

Mr. Russell has for a considerable number of years been in charge of the Handley Page Wind Tunnel, and has, therefore, not only been in close touch with, but has actually played an important part in, the development of the Handley Page automatic wing tip slot, and the even more recent "Interceptor" addition. In the following pages Mr. Russell explains the action of this form of lateral control, and gives in the form of curves quantitative values of lift and drag for various types of lateral control.

The problem of lateral control at low speeds is now receiving considerable attention, and already much progress has been made towards obtaining complete lateral stability and control of an aeroplane flying near or in the stalled condition.

It may be said that the advent of the Handley Page Automatic Wing Tip Slot has definitely removed the danger of the incipient spin following a stall, and has given to a machine so fitted a degree of lateral stability at the stall unattained so far by any other method.

The reason for this increase in stability is simply that due to the extension of the lift curves of the slotted portions of the wing, the autorotative tendencies of the machine are delayed to a very high angle of incidence, an attitude which it is extremely difficult to reach with an aeroplane carrying the normal size of elevator and tail plane.

The next problem that presents itself is that of adequate aileron control. In a normal unslotted aircraft any application of aileron control to counter a rolling tendency during stalled flight invariably aggravates matters, due to the already unstable and autorotative characteristics of a machine at this attitude, coupled with the fact that the correcting rolling moment due to the ailerons is very small, whilst the induced adverse yawing moment, even with differential ailerons, is considerable.

The addition of Wing Tip Slots alone has made a very considerable change in these factors, as will be shown in the comparisons further on. The chief point, however, is that owing to the preservation of lateral stability due to the slots at and after the stall it is possible to utilise any rolling moment due to the ailerons quite apart from the fact that the value of the rolling moment is considerably increased by the slots.

Recent experiments have shown that, although automatic wing tip slots alone provide greatly increased aileron effectiveness, it is desirable on some types (Interception Fighters, etc.) to sharpen up still further the magnitude of this control.

Very successful results have been obtained with the "Interconnected Slot and Aileron Control" (Figure 1) experimented with by the Royal Aircraft Establishment. The interconnection between the slot and aileron in this method is such that on moving an aileron upwards, the slot immediately in front of it is pulled back into the closed condition, the slot on the side of the downward moving aileron remaining open. The result of this at stalling attitudes, is a very powerful rolling moment, due to the slot-closed-side of the wing being stalled, whilst the other side is developing high lift with the open slot. The adverse yawing moment, due to the aileron, is considerably lessened also, and is, in fact, actually of opposite sign when reduced to body axis.

An attempt to improve upon this type of control, and at the same time to leave the automatic slots unhindered in their action, has led to the successful development of the "Handley-Page Slot and Interceptor Control" (Figure 2). This device is in the form of a narrow strip of metal or, in other words, a flat plate which is situated on the top surface of the wing immediately behind the front slot; it is connected to the aileron control in such a way that for normal or

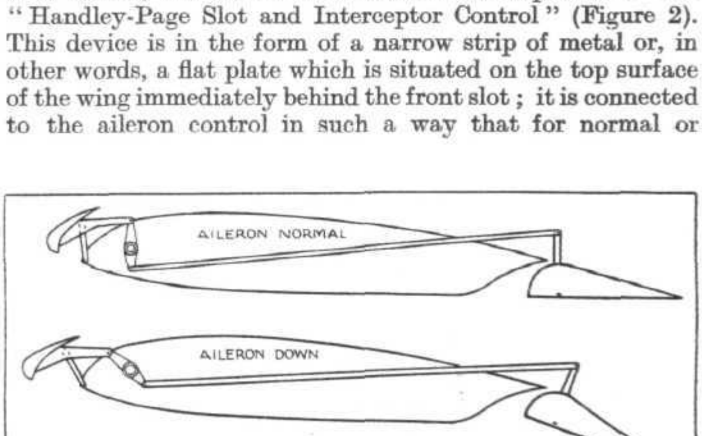


FIG. I.

Slot-aileron interconnection.

downward moving aileron it is held flush with the top surface of the wing, but on moving the aileron upwards, it is caused to project above the surface and so destroy the effect of the front slot. When both front slots are closed the interceptors are automatically put out of gear with the ailerons.

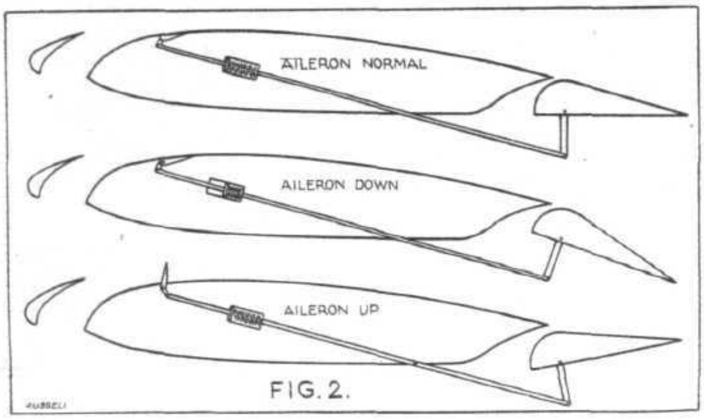


FIG. 2.

Aileron and interceptor interconnection. Slot open.

The advantages of this control over the "Interconnected Slot and Aileron" type, lie in the simplicity of the actuating mechanism, the light loading to the control system and the increased effectiveness as compared with the "Interconnected" type.

The following comparisons of the three types of control discussed above are based on Wind Tunnel tests made on a modified R.A.F. 15 wing section. Wind axes results are used throughout, but at the end a corrected result for body axes is given. "Square" setting ailerons are assumed for this comparison.

For the sake of clearness, the comparison is split up into two parts—(*a*) Rolling moments and (*b*) yawing moments.

(*a*) Rolling Moments (Wind Axes)

CASE 1.

Interconnected Slot and Aileron Control.—Imagine an aeroplane (Fig. 3) to be flying just above the stall at an angle of incidence α (Fig. 4) and with a wing lift of a. Now let the machine be rolled in the direction shown by the arrows.

The incidence of wing tip t_2 at an instant will now be increased by an amount $\delta\alpha$, and its new angle will, therefore, be $(\alpha + \delta\alpha)$ and its corresponding lift will be b; similarly, wing tip t_1 will have its incidence decreased by an amount $\delta\alpha$, its new angle being $(\alpha - \delta\alpha)$ and its corresponding lift being e.

If at this instant an attempt is made to check this roll, by means of the "Interconnected Slot and Aileron Control" the result is as follows :—

(1) The aileron on wing tip t_2 is pulled down, and its interconnected slot pushed open. The result of this is that due to the slot alone, the lift of this wing tip is raised from b to c, and is still further raised to d by virtue of the "down" aileron.

(2) The aileron on wing tip t_1 is pulled up, the interconnected slot remaining closed. The lift on this wing tip is, therefore, reduced from e to g, due to the aileron alone.

The difference in lift between the two sides, *i.e.*, $(d\text{-}g)$ is, therefore, initially available as a correcting rolling moment to check the original rate of roll.

CASE 2

Automatic Slot Control :—Take the same conditions as for Case 1, *i.e.*, the aeroplane is rolling in the direction indicated in Fig. 3. Wing tip t_2 will therefore be at an angle of incidence of $(\alpha + \delta\alpha)$, but its lift will now be "c" due to the open auto-slot. Wing tip t_1 will be at an angle of $(\alpha - \delta\alpha)$, but its lift will be "f" due to the open auto-slot.

If an attempt is made to check the roll, by means of the ailerons, the result is :—

(1) Due to the "down" aileron on wing tip t_2 the lift is increased from "c" to "d."

(2) Due to the "up" aileron on wing tip t_1 the lift on this side is decreased from "f" to "h."

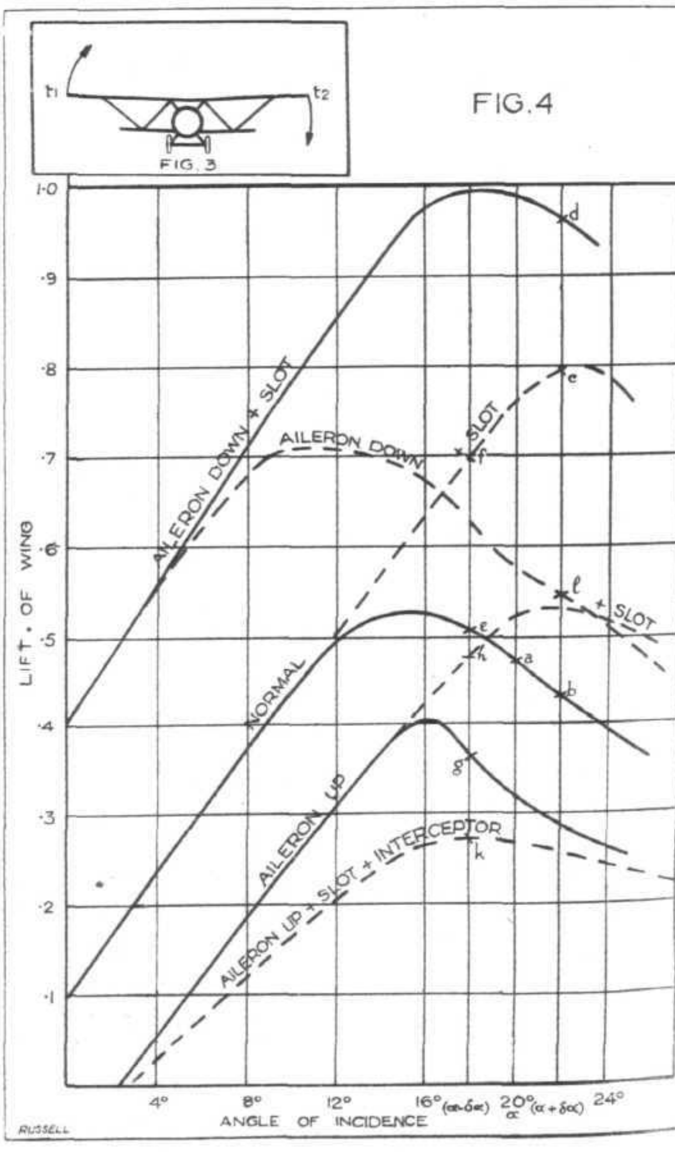
The difference in the lift between the two sides, *i.e.*, $(d - h)$, is therefore available initially as a correcting rolling moment to check the original rate of roll.

COMPARISON BETWEEN CASES 1 *AND* 2.

The conclusions of Cases 1 and 2 are very alike, *i.e.*, at the instant of applying the ailerons to check a rate of roll, the initial correcting moments formed by the difference in lift of the wing tips are practically the same in each case, the "interconnected" type giving a slightly better result.

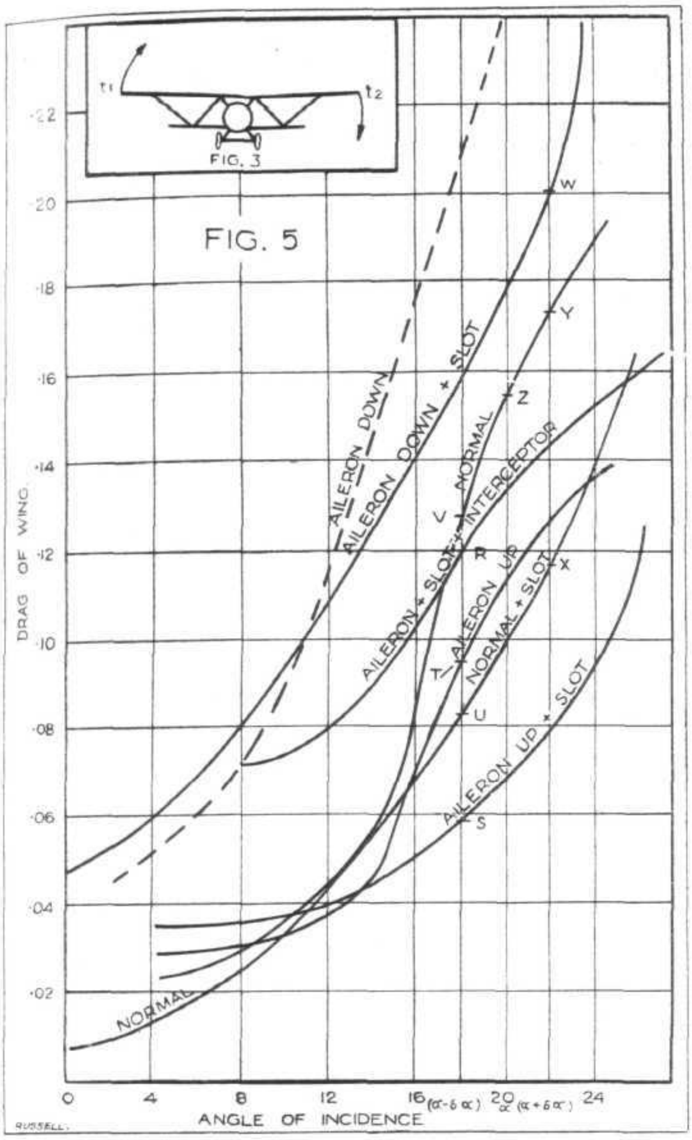
At a first glance, therefore, it would appear that there is little to choose between either arrangement. On considering the time taken to damp out the original roll, however, the "interconnected-slot and aileron" is decidedly more effective than the "auto-slot" method.

In both methods the correcting moment obviously changes as the original rate of roll is decreased, but in the "interconnected" method the change in the value of this moment is less than in the "auto-slot" case, the reason being that in the "interconnected" method as the rate of roll is decreased, the incidence $(\alpha + \delta\alpha)$ on wing tip t_2 will also



be decreased, resulting in a slight increase in the value of its lift "d." Likewise, the incidence $(\alpha - \delta\alpha)$ on tip t_1 will increase, but due to the absence of a slot on this side t_1 will commence to stall, resulting in a decrease in its lift "g."

In the case of auto-slot control, exactly the same occurs for wing tip t_2 as in the above case, but instead of t_1 stalling



and losing lift, it will continue to gain lift, due to the open slot as its angle ($\alpha - \delta\alpha$) is increased.

The fall off in the value of the correcting moment is, therefore, less in the "interconnected" type, and in consequence the damping out of the original rate of roll will be more rapid than in the case of the auto-slot control.

CASE 3

Automatic Slots and Interceptor Control :—Take the same conditions as for Cases 1 and 2, the aeroplane rolling as indicated in Fig. 3. Both auto-slots are open as in Case 2.

The result of attempting to check the roll by means of the ailerons and interceptor is :—

(1) Due to the "down" aileron on tip t_2, its lift is increased from "c" to "d."

(2) Due to the "up" aileron and interceptor on tip t_1 its lift is reduced from "f" to "k."

The difference in lift between the two sides available as a correcting moment is therefore initially $(d - k)$.

Comparing the three cases Nos. 1, 2 and 3, it will be seen that as far as the initial correcting moment is concerned, the "interceptor and aileron control" gives the highest value, and should, therefore, give a better, or at least as good a result as the "interconnected slot and aileron" type.

Again, from the point of view of the time taken to damp out the roll, the interceptor control should still prove to be better than the "interconnected slot" method, although the rate of change of its initial value $(d - k)$, with the slowing down of the roll, would be slightly less than the rate of change of $(d - g)$ for the "interconnected slot" type (Fig. 4), but since the *initial* value of $(d - k)$ is considerably greater than $(d - g)$, and also since the rates at which both values alter is approximately equal, any intermediate value of the correcting rolling moment during the slowing-up process is higher for the "interceptor and aileron control."

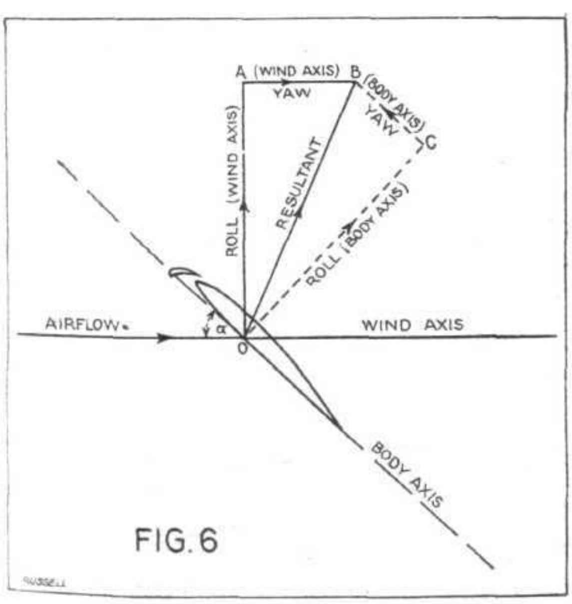
From this it follows that the "interceptor" control provides a means for checking a roll equally as effective as the "interconnected slot" gear.

Referring to Fig. 4, it will be seen also that the "interceptor" method is superior to the "interconnected" method in starting a roll from rest. This is due to the decrease in lift of the wing tip with aileron up, slot open, and interceptor as compared with the same wing tip with "up" aileron only, as in the "interceptor" case. The conditions for the "down" aileron side are, of course, the same in both methods.

(*b*) Yawing Moments (Wind Axes)

CASE 1

Interconnected Slot and Aileron Control :—Imagine the aeroplane to be flying at the same incidence α as in the previous comparisons and with a wing drag of "Z." If the same rate of roll as in the previous cases be generated in the direction shown in Fig. 3, wing tip t_2 will arrive at an incidence of ($\alpha + \delta\alpha$) and a corresponding drag of "Y" (Fig. 5). Similarly, wing tip t_1 will be at an angle of ($\alpha - \delta\alpha$) its corresponding drag being "V."



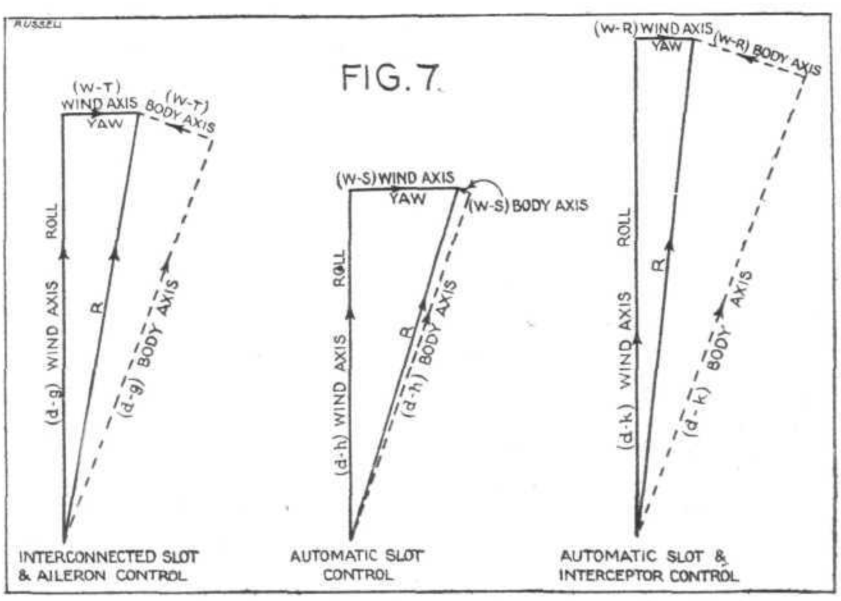


Fig. 7 **gives a comparison of three types of lateral control when referred to body axes. Angle of incidence + 20 degrees in each case. Body axes taken as along and perpendicular to chord of wing.**

Immediately the ailerons are set to check the roll the following occurs :—

(1) The aileron on wing tip t_2 is pulled down and its interconnected slot pushed open. This causes the drag "Z" to be increased to "W."

(2) The aileron on wing tip t_1 is pulled up, the interconnected slot remaining closed. The drag on this side is, therefore, reduced from "V" to "T"

The difference in drag (W-T) between the two sides therefore produces a yawing moment towards the rising wing.

CASE 2.—*Automatic Slot Control* :—Given the same conditions as for Case 1, wing tip t_2 will be at an angle of incidence of $(\alpha + \delta\alpha)$, but its drag will now be "X" due to the open auto-slot. Wing tip t_1 will be at an angle of $(\alpha - \delta\alpha)$ but its drag will be "U" due to the auto-slot. On setting the ailerons against the roll, the result is :—

(1) Due to the "down" aileron, on wing tip t_2 the drag is increased from "X" to "W."

(2) Due to the "up" aileron, on wing tip t_1 the drag on this side is reduced from "U" to "S."

The difference in drag causing a yawing moment towards the rising wing is, therefore (W-S).

CASE 3.—*Automatic Slots and Interceptor Control* :—Taking the same conditions as before, with both slots open as in Case 2. The result of attempting to check a roll by means of the ailerons and interceptor is :—

(1) Due to the "down" aileron on tip t_2 its drag is increased from "X" to "W."

(2) Due to the "up" aileron and interceptor on tip t_1 its drag is increased from "U" to "R."

The difference in drag causing a yawing moment towards the rising wing is, therefore (W − R).

Comparing these three cases, it will be seen that the adverse yawing moment induced by the lateral control is greatest in the case of the normal automatic slot control and least for the automatic slot and interceptor type, the "Interconnected" type being about mid-way between the two.

This difference is brought out more clearly, perhaps, when the results are reduced to body axis, the method being as follows :

Figure 6 shows the profile of a wing section inclined to the airflow or wind axis at an angle of incidence α.

OA is the sum of the forces producing roll about an axis parallel to the airflow, whilst AB is the sum of the forces producing yaw about an axis perpendicular to the airflow or, in other words, they are proportional to the rolling and yawing moments about wind axes. OB is their resultant which is, of course, independent of axes.

It is, therefore, quite simple to reduce this resultant into components along and perpendicular to the longitudinal body axis which, in this case, is taken to be the wing chord. The new components become OC (Roll) and BC (yaw.)

Figure 7 shows the results discussed above converted by this method to body axes corresponding to components along and perpendicular to the wing chord line, and it will be seen that the "Automatic Slot and Interceptor" control is decidedly better than the other types with regard to both rolling moment and yawing moment in the direction of roll.

The Author is desirous of expressing his thanks to Messrs. Handley Page, Ltd., for permission to make use of certain Wind Tunnel data.

AN ANALYTICAL METHOD FOR ESTIMATING THE TAKE OFF RUN AND LANDING RUN OF AN AEROPLANE.

By R. S. STAFFORD.

In THE AIRCRAFT ENGINEER, published on May 30, 1929, there appeared a method for estimating the length of run required to take off an aeroplane, which, although possessing the advantage of straightforwardness and accuracy (as far as the aeroplane characteristics are determinable from a general arrangement drawing), suffers from the obvious disadvantage of being extremely tedious.

It was after the Author of the present article had performed many calculations of take-off run, somewhat after the manner Mr. Fenton describes, that it occurred to him the estimation might easily be reduced to an analytical process, by making one or two legitimate assumptions.

The formulæ as developed below have been applied to several examples which were previously worked out by the tabular method, and it was found that in every case, the differences in the resulting "run" were of an order entirely attributable to slide rule errors.

It is assumed that the lift and drag characteristics of the aeroplane are known, either from a Wind Tunnel test or by estimation from the general arrangement drawing.

Now let W = total weight of the aircraft (lbs.)
A = Area of wings (sq. ft.)
w = wing loading lbs. per sq. ft. = W/A
K_L = Lift coefficient of wing in the attitude of take-off.
K_D = Drag " " " "
K_B = Parasitic drag coefficient in the attitude of take-off.
$K_R = K_D + K_B$
μ Friction coefficient (0·05 to 0·08).
ΔL = Additional lift due to the slip stream (lbs.)
ΔD = Additional drag due to the slip stream (lbs.)
T = Total thrust (lbs.)

If the effect of the inclination of the thrust axis is ignored and the aircraft is assumed to run along the ground with constant inclination, corresponding to a lift coefficient K_L, then the acceleration at any instant is given by :—

Acceleration =

$$\frac{d^2x}{dt^2} = \frac{g}{W}\left(T - \mu\,(W - K_L\rho AV^2 - \Delta L) - \Delta D - K_R\rho AV^2\right) \text{ ft. sec.}$$

$$= \frac{g}{W}\left(T - \mu W - (\Delta D - \mu\,\Delta L) - (K_R - \mu K_L)\,\rho AV^2\right)\ldots \quad (1)$$

Now for airscrews of normal design and with pitch/diameter ratio not in excess of about 1·0, the thrust is a linear function of the forward speed, and in most cases where there is a departure from the straight line law, it is generally sufficiently accurate to draw a mean straight line. Hence, we can replace T by the function A + BV, where A and B are constants derived from the T and V curve.

Now consider the quantity $(\Delta D - \mu\,\Delta L)$ representing the effective decrease in accelerating force due to the slipstream.

If V_s= slip stream velocity Ft/s.
λA = area of wings affected by the slipstream.
K_{Rs} = total drag coefficient for the parts within the slipstream.
$= K_B$ (in slip stream) $+ \lambda K_D$.

Then $\Delta D - \mu\Delta L = \rho A\,(V_s^2 - V^2)\,(K_{Rs} - \mu\lambda K_L) = (V_s^2 - V^2) \times$ constant (very nearly), the variation in this constant is due to the variable contraction of the slipstream and is very small. Now, for a curve of $(V_s^2 - V^2)$* plotted against V as abscissae, it will be found that over the first 50 per cent. of the take-off speed range, there is a gradual rise in the curve, while for the latter half, the curve remains practically parallel to the V axis, from which it follows that the quantity $\Delta D - \mu\Delta L$ can be taken as constant throughout the range of speeds generally associated with the take-off run. The greatest error in this assumption occurs at the lowest speeds, *i.e.*, the commencement of the run, where the distance traversed for a given increment in speed is small compared with the corresponding distances near the take-off speed, so that the final error is likely to be very small indeed. In fact, the writer has found in the case of numerous examples that the error involved by taking $\Delta D - \mu\Delta L$ as constant is of the order of 0·5 per cent.

* The method used for calculating slipstream velocity is well known, and need not be discussed here.

The increase in drag, due to the change in the direction of the resultant force on the part of the wings in the slipstream is neglected. This is in any case, a very small correction, and can readily be incorporated in the quantity $\Delta D - \mu \Delta L$ if necessary.

Equation (1) is now rewritten :—

$$V \frac{dv}{dx} = \frac{g}{W} (a + BV + bV^2) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where $a = A - \mu W - (\Delta D - \mu \Delta L)$

and $b = - \rho A (K_R - \mu K_L)$.

A curve of $K_R - \mu K_L$ is plotted against angle of incidence and generally a minimum occurs at $K_L = 0 \cdot 2$ (approximately). If this value corresponds to a reasonable attitude for the aircraft for take-off, then we may use :—

$$b = - \rho A (K_R - \mu K_L)_{min.}$$

In general, there is only very slight variation in the quantity $K_R - \mu K_L$ when the thrust line is horizontal, as compared with the minimum value.

Separating the variables in (2) we have :—

$$\frac{g}{W} dx = \frac{VdV}{bV^2 + BV + a}$$

or

$$\frac{bg}{W} dx = \frac{VDv}{(V - \alpha)(V - \beta)}$$

where

$$\alpha = \frac{- B + \sqrt{B^2 - 4ab}}{2b}$$

and

$$\beta = \frac{- B - \sqrt{B^2 - 4ab}}{2b}$$

$$\therefore \quad \frac{bg}{W} x = \int_O^{Vt} \frac{VdV}{(V - \alpha)(V - \beta)}$$

Integrating by partial fractions, we have :—

$$\frac{bg}{W} x = \frac{1}{\alpha - \beta} \left[\alpha \log_e \frac{\alpha - Vt}{\alpha} - \beta \log_e \frac{\beta - Vt}{\beta} \right]$$

$$\therefore \quad x = \frac{2 \cdot 3W}{bg(\alpha - \beta)} \left[\alpha \log_{10} \frac{\alpha - Vt}{\alpha} - \beta \log_{10} \frac{\beta - Vt}{\beta} \right] \text{ feet.. (3)}$$

This equation gives the run from rest to the take-off speed Vt in the absence of wind.

Now let the run be made directly into a wind whose velocity is U ft./sec.

$$\text{Then } \frac{bg}{W} x = \int_U^{Vt} \frac{V\,d\,V}{(V - \alpha)(V - \beta)}$$

$$= \frac{1}{\alpha - \rho} \left[\alpha \log_e \frac{Vt - \alpha}{U - \alpha} - \beta \log_e \frac{Vt - \beta}{U - \beta} \right]$$

$$\therefore x = \frac{2 \cdot 3\ W}{bg(\alpha - \beta)} \left\{ \alpha \log_{10} \frac{Vt - \alpha}{U - \alpha} - \beta \log_{10} \frac{Vt - \beta}{U - \beta} \right\} \text{ feet ...(4)}$$

The calculation of the various constants used in the equations (3) and (4), and the final calculations for the runs can be performed in about one-quarter of the time involved in the laborious tabular method. An allowance for the increased run due to the manœuvre of dropping the tail at the end of the run can be allowed for.

Landing Run

As in the case of taking off, the length of the landing run is dependent to a great extent on the piloting of the aircraft, the run being considerably increased when the machine touches with "tail up," and continues to run for some length in this attitude. Assuming the wheels and tail skid to touch the ground simultaneously, and that the subsequent run to rest is performed in this attitude, we can find a simple mathematical expression for the length of run.

The motion of the aeroplane moving over the ground with forward speed V ft./s. may be expressed :—

$$\frac{W}{g} \times \text{deceleration} = \mu W + \text{air resistance} - \mu \times \text{wing lift.}$$

$$\text{or} \quad \frac{-W}{g} V \frac{dV}{dx} = \mu W + K_R \rho A V^2 - \mu K_L\, \rho A V^2$$

$$\therefore \quad - V \frac{dV}{dx} = \frac{g}{W} \left\{ \mu W + (K_R - \mu K_L) \rho A V^2 \right\}$$

$$\therefore \quad - \frac{dx}{dV} = \frac{W}{g} \frac{V}{\mu W + (K_R - \mu K_L) \rho A V^2} = \frac{W}{g} \frac{V}{a + bV^2} \text{ (say)}$$

$$\text{whence} \quad \int dx = \frac{-W}{g} \int \frac{VdV}{a + bV^2}$$

Now the limits for the integration on the RHS are, Vo the alighting speed of the aircraft and $V = O$.

$$\text{Hence } x = - \frac{w}{g} \int_{Vo}^{O} \frac{VdV}{a + bV^2} = \frac{-W}{2bg} \int_{Vo}^{O} \frac{2bVdV}{a + bV^2}$$

$$= - \frac{W}{2bg} \Big[\log a + bV^2) \Big]_{Vo}^{O} = \frac{W}{2bg} \log \frac{a + bV_o^2}{a}$$

$$= \frac{2 \cdot 3\ W}{2\rho A g (K_R - \mu K_L)} \log_{10} \frac{\mu W + (K_R - \mu K_L) \rho A V_o^2}{\mu W}$$

$$= \frac{2 \cdot 3 \omega}{2b\rho (K_R - \mu K_L)} \log_{10} \left(1 + \frac{\rho(K_R - \mu K_L)\ V_o^2}{\mu w} \right)$$

If we put Vo = engine off stalling speed, *i.e.*, $V_o^2 = \frac{w}{\rho K_L \max.}$, and $\rho = 0 \cdot 00237$.

$$\text{Then } x = \frac{15 \cdot 06 w}{K_R - \mu K_L} \log_{10} \left(1 + \frac{K_R - \mu K_L}{\mu K_L \max} \right) \ldots\ldots(5)$$

N.B.—K_R and K_L correspond to the wing incidence with wheels and tail skid touching.

Landing Run with Wind Speed U ft./sec

Assuming that the aircraft lands into the wind, and that V represents the airspeed relative to the aircraft.

Alighting speed = Vo as before, and airspeed with aircraft at rest = U.

Whence

$$x = \frac{2 \cdot 3W}{2bg} \left[\log_{10} (a + bV_o^2) - \log_{10} (a + bU^2) \right]$$

$$= \frac{2 \cdot 3W}{2bg} \log_{10} \frac{a + bV_o^2}{a + bU^2}$$

$$= \frac{2 \cdot 3W}{2g\rho A (K_R - \mu K_L)} \log_{10} \frac{\mu W + \rho A\ (K_R - \mu K_L) V_o^2}{\mu W + \rho A (K_R - \mu K_L\ U^2)}$$

$$= \frac{15 \cdot 06 w}{K_R - \mu K_L} \log_{10} \frac{\mu + \frac{\rho}{w} (K_R - \mu K_L) V_o^2}{\mu + \frac{\rho}{w}\ (K_R - \mu K_L) U^2}$$

$$(\text{Put } U = \lambda_1 Vo) = \frac{15 \cdot 06\ w}{K_R - \mu K_L} \log_{10} \frac{\mu + \frac{K_R - \mu K_L}{K_L \max}}{\mu + \lambda^2_1 \frac{K_R - \mu K_L}{K_L \max}}$$

$$\therefore\ x = \frac{15 \cdot 06 w}{K_R - \mu K_L} \log_{10} \frac{\mu K_L \max. + (K_R - \mu K_L)}{\mu K_L \max. + \lambda^2_1 (K_R - \mu K_L)} \ldots (6)$$

Determination of μ *from full scale tests* :—By means of equations (5) and (6) it is a simple matter to plot a series of curves of landing runs *versus* friction coefficient for a given aircraft, from which, provided that due care is exercised in estimating the alighting speeds, a value of μ appropriate to the aircraft can be found.

It should be noted that great care is necessary in finding V_o, since an error of 1 per cent. in this quantity will mean an error of about $3\frac{1}{2}$ per cent. in the calculated value of μ.

[*Worked-out examples illustrating the use of Mr. Stafford's method will be published next month.*—ED.]

AN ANALYTICAL REVIEW OF THE AERO ENGINE EXHIBITS AT OLYMPIA

By N. E. KEARLEY, A.M.I.E.E., A.M.I.A.E.

(*Continued from page* 7.)

Valve Gear (*Contd.*)

The previous instalment of this review closed with some notes on the arrangement of the valves and camshafts of the water-cooled engines at Olympia. Poppet valves were used without exception in the water-cooled engines at the Show. In the matter of rocker or tappet arrangement each designer appeared to have ideas differing from those of his rivals. An interesting comparison is provided by the valve and tappet arrangements of the new Lorraine and Rolls-Royce engines. Each has four valves per cylinder operated by a single camshaft; in the case of the Rolls-Royce engines the pairs of similar valves are arranged in the usual manner, *i.e.*, all the inlets are on one side and all the exhaust valves on the other, but in the 660-h.p. twelve-cylinder broad-arrow Lorraine engine the similar valves are arranged in pairs transversely. This latter arrangement may, at first sight, appear to involve intricate manifold or valve port design with consequent casting difficulties, but actually the reverse is the case. By juxtaposing the pairs of similar valves of adjacent cylinders the head casting of each bank may be divided, as regards the valve ports, into five transverse passages, three inner main passages which are each common to one group of four similar valves and two outer ports, and one at each end of the cylinder bank, each common to one pair of valves. The latter and the central main ports form the exhaust outlets, whilst the other two main passages form the intake manifolds, each being supplied by a separate carburettor bolted up as closely as possible to the cylinder block. The pairs of similar valves in this engine are operated through a single T-shaped tappet, the stem of which is located between the valves and acts as a pump for supplying oil to the contacting faces of the cam and tappet—a very neat and apparently efficient arrangement. In the case of the Rolls-Royce engines, each valve is operated by a separate tappet arm which is pivoted at one end and bears on the valve stem at the other, the cam bearing on an intermediate hardened pad on the top face of the lever; the tappet lever pivots of all the similar valves are provided by a common support shaft through which lubricant is forced to the pivot bearings and through passages in the levers to the contact faces.

A further interesting example of valve actuation is provided by the Isotta-Fraschini engines. Although twin camshafts are used for operating the four valves of each cylinder, one cam only is employed for each pair of similar valves, these being arranged all on the same side, as in the Rolls-Royce design. Each cam bears on the centre of a T-shaped bridge piece which is fitted at each end with adjustable tappet screws; the stem of the T, however, is not vertical in this case but horizontal, the end of the stem being pivotally anchored to the head casting.

The "Nimbus" remains unique in having three valves per cylinder, one inlet and two exhaust, and a single camshaft, the inlets being rocker actuated, as the camshaft is located directly over the exhaust valve stems. The orthodox type of double or triple concentric helical valve springs were employed without exception on the water-cooled engines under review.

The only exception to the usual vertical and inclined shafts for driving the camshafts through bevel gearing was provided by the eighteen-cylinder broad-arrow type Farman engine, the small cylinder dimensions of which allow a train of gears to be employed. One of the intermediate gear wheel spindles of each bank provides a convenient drive for the H.T. distributor of its respective group of cylinders.

Crankcases, Crankshafts, Bearings and Connecting Rods.—Apart from the material of which they are made, the crankcases of the water-cooled engines did not reveal any startling variation in design or points of interest. The alloy known as Electron was employed by a number of continental makers, notably Mercedes-Benz and Isotta-Fraschini. The engines shown by both these makers were provided with crankcases in which a shallow detachable tray formed the bottom of the crankcase and could easily be removed to facilitate inspection of the crankshaft and big end bearings. An interesting feature of the Rolls-Royce engines was the provision of two transverse tie bolts for securing each main bearing cap in addition to the usual vertical studs depending from the top half of the crankcase.

The crankshafts of the water-cooled engines were without exception machined from single forgings and all except one were provided with bearings between each crank throw, these being in most cases of the plain split bush type, although there were some exceptions. The only exception to the normal crankshaft design, in which bearings are arranged on both sides of each crank throw, was provided by the 450 h.p. Lorraine type 12 Ed. broad-arrow engine. In this engine each group of four cylinders is arranged in two pairs, in which the cylinder barrels are placed almost in contact with each other, the crankshaft being carried by three plain bearings only, one at each end and one at the centre, between the pairs of cylinders. A further point of interest in the crankshaft design of this engine is that the webs that are common to each pair of crank throws, although of stout cross-section, have a large amount of metal removed by axial boring out for lightness, as the bores are open, the oil being supplied to the crankpins through channels leading from the adjacent journals, each of which is fed by a gallery pipe supplied from the oil pump.

As the Napier "Lion" series have been the only water-cooled aero engines in this country having roller bearings provided throughout for the journals and big end bearings, it is of interest that the big Mercedes-Benz engine shown at Olympia was similarly provided.

In two of the Lorraine engines, a "mixed" arrangement of crankshaft bearings is employed; in the 660 h.p. twelve-cylinder broad-arrow engine, for instance, three roller and two plain bearings are used, the roller bearings being located at the centre and ends whilst the plain bearings are placed intermediately and form oil distributing centres for the crankpins located at either side. The master rod big end and wrist pin bearings of this engine are of the plain white-metal lined type, as are those of all the other broad-arrow engines under review, excepting the "Lions."

No marked variation in design was to be found in the connecting rod and big end arrangement of the broad-arrow engines, but in the V engines there are two distinct types. Some makers, notably Mercedes-Benz and Isotta-Fraschini, employ a master and an articulated rod secured by a wrist pin, but in the Rolls-Royce engines the big end of one rod bears directly on the crankpin, the lower end of the rod itself being slotted to accommodate the big end of the other rod which is fitted concentrically and bears on the external surface of the bearing shell of the rod attached to the crankpin. In this manner any difficulties arising from the different angularities of the two rods are obviated.

The arrangement of gudgeon pin and small ends does not appear to have finally crystallized out into one definite form. In some Lorraine engines, for instance, the pin is fixed in the small end, although the floating pin arrangement is the more common.

Reduction Gears.—Airscrew shaft reduction gears were well represented among the water-cooled engines, the direct drive being the exception rather than the rule. Actually, 67 per cent. were of the geared type, and of these the majority of gears were of the simple spur wheel type favoured by Rolls-Royce, Renault, and Mercedes-Benz. There were, however, two each of the bevel and spur epicyclic types of gear. As fitted by Lorraine the latter form enables an engine to be very rapidly and easily converted from a direct to a

geared drive or *vice versa* without in any way affecting the engine installation. One Hispano-Suiza engine was shown fitted with a Farman type bevel epicyclic gear, but the most interesting example of this form was provided by the 18-cylinder Farman, in which a ratio of 0·407 : 1 was obtained by making the driving bevel of a smaller diameter than the fixed one.

One form of reduction gear having a particular interest was that fitted to the racing "Lion" engine. This gear is of the countershaft type, and for compactness, yet having adequate tooth area, combined with the advantage of having the airscrew shaft coaxial with the crankshaft, this arrangement could hardly be improved upon.

Superchargers and Carburettor Arrangements.—It was left to Rolls-Royce to uphold British prestige among the supercharged water-cooled engines at the Show in the face of competition by foreign rivals. The latter were, however, competing between themselves, rather than against the British makers, as the latter were showing two engines fitted with induction boosters located between the carburettor and intake ports, whilst the foreign superchargers were both of the air compressor type—a type which does not appear to have attracted much attention in this country. The type would, however, appear to make for reliability in one respect, namely, the avoidance of damage to the rotor blades which is not unknown in the induction impeller type due to ice formed in the induction pipe being drawn into the rotor chamber. The air supplied by the compressor type, however, is heated by the process of compression, although this, too, is a disadvantage in itself, as it tends to nullify the effectiveness of the device as means for supplying a greater weight of air. An air-cooler is provided for in the Farman installation between the compressor and carburettor to remedy this defect. The rotors of all the superchargers at the Show were gear driven.

Apart from the location of the carburettors of the supercharged engines, which was, of necessity, fixed by the position of the blower (excluding the Farman), there does not appear to be as yet any settlement of the controversy as to whether the carburettors should be placed between or outside the cylinder banks. In the new Lorraine broad-arrow engine two carburettors are fitted to each bank of four cylinders, one at each side, in staggered relation. This arrangement, viewed in conjunction with the induction manifold design of this engine (previously referred to when dealing with the valve gear) would appear to be very sound. A somewhat striking contrast in carburettor arrangement and induction manifold design was provided by this new Lorraine engine and the old 12 Ed. Lorraine, also a twelve-cylinder broad-arrow type. In the latter engine a single and a duplex carburettor are fitted outside the outer cylinder banks, external branched manifolds of ungainly appearance being fitted between the outer valve ports and carburettors, whilst a long pipe from the duplex carburettor supplies a similar manifold fitted to the centre block. Continental designers appear to have gone thoroughly into the problem of mixture distribution and to have reached the conclusion that it pays (especially in the long run—or flight) to provide a separate carburettor for each pair of cylinders. This arrangement was employed on the Hispano-Suiza engine which recently broke the world's long distance record flight, the carburettors being arranged in a similar manner on both their V-type engines shown at Olympia.

(To be concluded.)

TECHNICAL LITERATURE

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SKIN FRICTION AND THE DRAG OF STREAMLINE BODIES. By Professor B. M. Jones, M.A., A.F.C. R. & M. No. 1199. (Ae. 360.) (12 pages and 8 diagrams.) December, 1928. Price 9*d*. net.

In Part I the drags of certain streamline models are compared with the skin friction on thin flat plates having the same exposed surface areas and the same lengths parallel to the direction of motion. For streamline solids of revolution at low Reynolds numbers the drags approximate to the skin friction on flat plates with laminar boundary layer (Curve A), while for high Reynolds numbers the approximation is to the skin friction with turbulent boundary layer (Curve B) : the transition from the one condition to the other occurs at roughly the same Reynolds numbers and in the same manner as for flat plates.

The Reynolds numbers at which experiments on such models are made in atmospheric pressure wind tunnels lie, as a rule, in this transition region and it is, therefore, concluded that the wide differences found in wind tunnel experiments upon the drags of different streamline bodies and of the same body in different tunnels are due, in the main, to differences in the mode of transition from laminar to turbulent boundary layer, and hence, may be expected to disappear at higher Reynolds numbers. The evidence collected in the diagrams suggests, though it does not confirm, that at the Reynolds numbers of full scale flight the drags of streamline solids of revolution, of fineness ratio more than 5, may be somewhat insensitive to minor changes in shape and approximate unexpectedly closely to the skin friction on flat plates of the same exposed areas.

The importance of a knowledge of the state of the boundary layer in all wind tunnel experiments on streamline bodies is emphasised and the use of forced turbulence in wind tunnels is suggested.

In Part II certain experimental results by Wieselsberger, Burgers, Taylor, Hansen, Gebers, Blasius, Prandtl and G. S. Baker for the boundary layer and for the skin friction on thin flat plates over a wide range of Reynolds numbers are collected and discussed and some further implications of the comparisons in Part I are considered.

WING FLUTTER AS INFLUENCED BY THE MOBILITY OF THE FUSELAGE. By R. A. Frazer, B.A., B.Sc., and W. J. Duncan, B.Sc., A.M.I.Mech.E. R. & M. No. 1207. (Ae. 368.) (33 pages and 4 diagrams.) November, 1928. Price 1s. 3d. net.

Hitherto, wing flutter has been investigated on the simplifying assumption that the fuselage is not set in oscillation by the flutter of the wings. Strictly, however, the fuselage and wings form a single dynamical system, all pars of which must participate to some extent in any vibration. Thus, the critcal speed at which instability develops in actual flight will be influenced by the mobility of the fuselage, and the object of the present investigation is to find the importance of the effect.

The fuselage and ailerons are treated as rigid bodies, while, in accordance with the usual theory of wing flutter,* the wings proper are assumed to be semi-rigid, *i.e.*, the displacements of all points of a wing relative to the fuselage are assumed to be uniquely specified by the flexural and torsional co-ordinates.

It is shown that the most general oscillation of the complete wing-body system is compounded of oscillations of merely two types, called "longitudinal-symmetrical" and "lateral-anti-symmetrical," respectively.

In the longitudinal-symmetrical oscillations, the port and starboard wings move equally and in phase, and the ailerons are consequently subject to an elastic control provided by the cables. The motion of the aeroplane as a whole is of the "longitudinal" type, and it is found that the critical flutter speed is almost identical with that calculated on the assumption of an immobile fuselage. Thus, it may be concluded that the influence of the mobility of the fuselage upon the critical speeds is negligible in this type of motion.

On the other hand, in the lateral-anti-symmetrical oscillations, the port and starboard wings move equally but in opposition and the ailerons are virtually free from elastic control. The oscillations of the aeroplane as a whole are of the "lateral" type, and in this case the mobility of the fuselage is found to have an important stabilising influence.

Approximate theories of the two types of flutter are worked out and shown to be in good agreement with the more exact theories. In the longitudinal-symmetrical motion it is assumed that the only important oscillation of the fuselage is that normal to the flight path, whereas in the lateral-antisymmetrical motion the important oscillation is in roll. The approximate theory if applied to find the influence of variation of the longitudinal moment of inertia of the fuselage upon the stability, and it is shown that the stabilising effect of fuselage mobility is greatest when this moment of inertia is small.

Some experimental confirmation of the theoretical results has been obtained.

* See R. & M. 1155 (Ref. 1).

ON THE FLOW OF AIR ADJACENT TO THE SURFACE OF AN AEROFOIL. By N. A. V. Piercy, D.Sc., and E. G. Richardson, B.A., D.Sc. R. & M. No. 1224 (Ae. 379). (23 pages and 13 diagrams.) December, 1928. Price 1*s*. 3*d*. net.

This paper describes an experimental investigation of the flow very close to the surface of an aerofoil in 2-dimensional motion at various angles of incidence using a hot-wire instrument and working at low wind velocities. To systematic explorations of velocity and pitot head are added some measurements bearing on the fluctuation of velocity.

The results show the area of low velocity near the front stagnation point to be a region of unsteadiness while a wedge of turbulence bounded by a vortex sheet appears driven upstream into the fluid from above the trailing edge. With increase of incidence the first turbulent region recedes under the nose of the aerofoil while the second, growing rapidly, approaches the nose and is no doubt the main contributory cause to limitation of lift and the associated large increase of drag. The thickness of the boundary layer varies greatly over the upper surface and appears to increase in a series of steps. The first of these is located near to the nose and may indicate the inception of turbulence. In this region the thickness of the boundary layer is shown to diminish rapidly with increase of Reynolds number at the "scale" of the investigation, and it is skirted by a narrow band of high velocity.

The general flow beneath the lower surface is devoid of the violent turbulence characterising that on the other side of the aerofoil. Conditions approximating to those observed by Burgers and Zijnen for a flat surface are indicated while a distinguishing feature is a region of remarkably high velocity situated just under the trailing edge. The variation of skin friction round the contour is calculated from the velocity gradients.

HIGH FREQUENCY FATIGUE. By C. F. Jenkin, C.B.E., M.Inst.C.E., and G. D. Lehmann, B.Sc. R. & M. No. 1222. (M. 62.) (34 pages and 24 diagrams.) December, 1928. Price 1*s*. 6*d*. net.

The object of these researches was to determine the effect of the frequency of alternation of stress on the fatigue limits of various metals. The work was carried out in the Engineering Laboratories, Oxford. Tests were made on rolled, normalised and hardened steel; rolled aluminium; annealed copper and normalised armco iron. The ordinary frequency employed in fatigue tests is 50 periods per second. Jenkin* in 1924 carried out tests up to 2,000 periods per second, and in the research described in this paper tests were made at frequencies up to 20,000 periods per second. In all the higher frequency tests the specimen consisted of a bar supported at the nodes, and vibrating freely. Jenkin used an electro-magnetic method to produce the vibrations, but this will not work for very high frequencies and a new method had to be invented. In the experiments now described fluctuations of air pressure acting directly on the specimen were used to make them vibrate and a number of methods were tried before a successful apparatus was evolved. The apparatus consists essentially of the two blowers used to vibrate the specimen. Each blower consisted of a small adjustable resonating chamber, into which air was admitted by a throttle valve in the back, while the front was closed by one face of the specimen. The position of the specimen was so arranged that as it vibrated to and fro it alternately released the air pressure or allowed it to mount up in the chamber.

The strains were calculated on the assumption that the bar vibrated freely and the only measurement necessary was the amplitude of vibration at the centre of the bar. Lord Rayleigh has shown how the strains may be calculated for a long, thin vibrating bar. But using the method of vibrating by air, the bars had to have a moderate width and for the highest speeds they had to be short, so that Lord Rayleigh's theory was no longer sufficiently accurate. The experiments would have been impossible but for the assistance of Prof. Love, who explained how the known theory could be applied to bars of moderate width, such as could be used in our apparatus.

The results obtained were very interesting. In Jenkin's experiments the largest increase of the fatigue limit was only 15 per cent., but he pointed out that much larger rises were to be expected at higher frequencies. In the present tests increases of fatigue limit up to 60 per cent. have been recorded. It has also been found that the fatigue limit does not increase indefinitely with the frequency but reaches a maximum value, and in some tests was shown actually to fall at the highest frequencies. The greatest drop obtained beyond the maximum fatigue limit was about 9 per cent. of the maximum. This fall might have occurred for the other metals also, if they had been tested at still higher frequencies.

* R. & M. 982. High Frequency Fatigue Tests. By C. F. Jenkin.

THE GRAPHICAL AND ANALYTICAL DETERMINATION OF STRESSES IN SINGLE SPAN AND CONTINUOUS BEAMS UNDER END COMPRESSION AND LATERAL LOAD WITH VARIATIONS IN SHEAR, DISTRIBUTED LOAD AND MOMENT OF INERTIA. By H. B. Howard, B.A., B.Sc. R. & M. No. 1233. (Ae. 388.) (30 pages and 15 diagrams.) June, 1928. Price 2*s*. net.

This investigation was made primarily in order to find a method of simplifying strength calculations on wing spars carrying complex forms of lateral loading or changes of section at points other than those of main support. Such spars are of frequent occurrence in modern aircraft. The computation of their strengths by existing methods is often extremely laborious, and necessitates a high degree of arithmetical accuracy.

Graphical constructions by means of polar diagrams are described for drawing combined bending moment and shear force diagrams for single-span beams carrying concentrated loads with either discontinuous or continuous variations in distributed load and moment of inertia. Graphical constructions are given by which the three moment equations for continuous beams of this type can be found. Analytical expressions for these equations are included, which can be used in lieu of graphical constructions if preferred. Fully worked numerical examples will be found in the Appendix.

The polar diagram has manifest possibilities as an instrument for strength computation. It gives a clearer idea of the conditions in the beam and has less chances of error than the usual analytical methods. By its aid problems can be handled which would otherwise need special mathematical treatment. It thus considerably widens the range of cases that can be dealt with by ordinary methods.

FUEL FLOWMETERS DESIGNED TO MEASURE MASS FLOW. By P. S. Kerr, R. J. Penn, A.M.I.Mech.E., and W. C. Cooper, B.Sc. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1245. (E. 31.) (21 pages and 8 diagrams.) January, 1929. Price 1*s*. net.

For more than ten years various investigators have been endeavouring to produce an instrument for measuring the rate at which fuel is being consumed by an aircraft engine in flight. The fact that no satisfactory type has previously been evolved must be attributed to the extreme variations of temperature and pressure to which the instrument must be subjected.

Two flowmeters have been designed and tested on the bench and in flight.

A flowmeter has now been produced which is unaffected by density changes, such as those due to any temperature variations likely to be experienced in flight. The theory of the instrument indicates an accuracy in this respect within 0·25 per cent. over a density range of $\pm$ 10 per cent.

Laboratory tests on the first flowmeter over a temperature range of $+18°$ C. to $-10°$ C. indicate an overall accuracy within $\pm$ 1·0 per cent.

Laboratory tests on the second flowmeter using (*a*) aviation mixture, and (*b*) kerosene, show agreement of readings to within 1·0 per cent. This test is equivalent to a test with aviation mixture over a temperature range of $+25°$ C. to $-30°$ C.

Flight tests with two flowmeters of the second type show an overall accuracy within $\pm$ 2·0 per cent. at all altitudes up to 16,000 ft.

Appendices contain details of the R.A.E. tests, and give an account of the fuel economy obtained by the use of the flowmeter.

SOME EARLY MODEL EXPERIMENTS ON DEVICES FOR IMPROVING LATERAL CONTROL NEAR THE STALL. By H. B. Irving, B.Sc., and A. S. Batson, B.Sc. R. & M. No. 1251. (5 pages and 8 diagrams.) July, 1929. Price 1*s*. net.

This note contains the first* definite proposal made to the Aeronautical Research Committee for a method of obtaining a lateral control in which the objectionable yawing moment associated with conventional ailerons near the stall can be eliminated or reversed while the rolling moment obtainable can be increased.

The model experiments on holes in wings with and without shutters were approved by the Committee and met with a fair measure of success in achieving the desired object.† As a result, it was recommended that further model experiments should be made at the R.A.E., on an actual design with a view to trying out the device on the full scale, not so much that the device was looked upon as practicable for general application as because its aerodynamic characteristics appeared to be desirable and worth trying out. With the publication of work on the slotted wing in February, 1921, one of the authors suggested that the slot should be tried and this line of investigation was accordingly discontinued.

* October, 1920.

† The experimental results were presented to the Committee in reports S. & C.1 and 1a (unpublished).

THEORETICAL RELATIONSHIP FOR A WING WITH UNBALANCED AILERONS. By A. S. Hartshorn, B.Sc. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1259. (Ae. 408.) (16 pages and 7 diagrams.) April, 1929. Price 9*d*. net.

The theory of aerofoils has been found to be of practical use for designers, and it has been thought desirable to extend the numerical data based on this theory to cover the case of an aerofoil with a sudden twist near the tips representing the effect of aileron displacement.

The constants for a rectangular aerofoil of aspect ratio 6 and four values of the aileron span have been evaluated by T. Asano.*

Another method of solving the general equation has been used by S. B. Gates.†

The case of a twisted aerofoil of elliptical plan form has been considered generally by S. B. Scarborough.‡

Theoretical values of the rolling moment, change in lift and change in pitching moment on the semi-span of a wing of rectangular plan form with displaced ailerons have been calculated for a series of values of the aileron span and for aspect ratios of 3, 6 and 9. The position of the centre of pressure of the change in load has also been evaluated. The values of rolling moment and increase in lift on the semi-span of an aerofoil of elliptical plan form with ailerons displaced one up and one down and also with both ailerons down are included.

The position of the centre of pressure of the increase in load due to aileron displacement is independent of the aileron angle. Its position along the span is independent of hinge position and almost independent of aspect ratio. The position along the chord is almost independent of the aileron span but varies rapidly with aspect ratio and hinge position. Approximate formulæ are suggested for rectangular aerofoils which give a good approximation within certain limits.

The influence of aileron displacement on induced yawing moment and hinge moment will be investigated later.

* Report No. 30. Aeronautical Research Institute, Tokyo.

† R. & M. 1175. An analysis of a rectangular monoplane with hinged tips.

‡ N.A.C.A. Report No. 200. Some problems on the lift and rolling moment of airplane wings.

EXPERIMENTS ON THE SPINNING OF A BRISTOL FIGHTER AEROPLANE. By K. V. Wright, B.A. Presented by the Director of Scientific Research, Air Ministry. R. & M. No. 1261 (Ae. 410). (7 pages and 2 diagrams.) May, 1929. Price 6d. net.

An account of previous attempts to determine the characteristics of the spinning motion of an aeroplane is given in Chapter II of R. & M. 1001,* from which the following is quoted :—" Full-scale work on spinning has never in the past been highly systematic, and a beginning has only just been made at the R.A.E. with experimental spins during which sufficient observations are to be taken to define completely the state of motion. Without data from such experiments as these, it is impossible to arrive at any precise interpretation of the reports of pilots who have flown the various types of machines." The experiments described in the present report were undertaken with the object of providing data for one type of aeroplane, and should apply approximately to most two-seater aeroplanes of the same class.

The aeroplane chosen for these experiments was a standard Bristol Fighter, fitted with a Rolls Royce Falcon III engine and a four-bladed airscrew. The engine was provided with a band brake, operated from the pilot's cockpit, and all the spins were carried out with the airscrew locked in the same position, in order to eliminate the gyroscopic and aerodynamic effects of the rotating airscrew on the motion of the aeroplane.

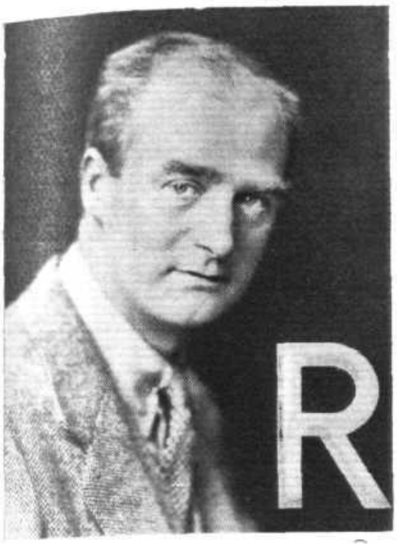
The motion of the spinning aeroplane was completely determined from measurements of the components of rotation, acceleration and vertical velocity. A number of spins were analysed and the angles of incidence and sideslip, and the radii of turn deduced.

The final incidences reached in the various spins analysed differ considerably, although the controls were approximately in the same positions for all the spins.

There is a progressive increase of incidence and of rate of rotation during the spin, and the spins do not reach a steady state until after a considerable time from the start. An oscillation in pitch is found to be superimposed on the spinning motion, and is accompanied by a periodic vari tion in the normal acceleration. The incidence of a spin can be determin to a good degree of approximation from the record of the accelerometer or rate of turn recorder alone.

The effects of variations in the positions of the control surfaces and centre of gravity on the character of the spin will be investigated. Experiments on the free flight of a 1/20th scale model are in hand, and the results will be compared with those of the experiments described in this report.

* R. & M. 1001. The spinning of aeroplanes.—By S. B. Gates and L. W. Bryant.



21 YEARS' AIRCRAFT CONSTRUCTION

Robert Blackburn Celebrates His "Coming of Age"

ROBERT BLACKBURN, who is one of the pioneers of British aviation, has now reached the years of discretion as an aircraft constructor, having begun his aeronautical career in 1909, or the same year that FLIGHT first appeared as a separate journal. And his faith in aviation is, needless to say, as great now as it was when, in 1908, he first began to interest himself in the subject of flying. Mr. Blackburn's "coming of age" as an aircraft constructor was celebrated on February 21, at the staff dinner and dance held by the Blackburn Aeroplane and Motor Co., Ltd., and North Sea Aerial and General Transport Co., Ltd., at Powolny's Restaurant, in Hull, when a presentation to Mr. Blackburn was made to commemorate his completion of 21 years' activities in aviation.

A Yorkshireman, he is the son of the late Mr. G. W. Blackburn, and was born in 1885. After being educated at Leeds Modern School, he took a degree in engineering with honours at Leeds University. He then proceeded to Germany, where he studied practical and technical engineering for two years, and subsequently spent another year and a half in Belgium and France equipping himself further on the scientific side of his profession.

Mr. Blackburn's visit to France was, perhaps, the turning-point in his career, for it was in Paris that he first took an active interest in aviation. His keenness was undoubtedly stimulated by meeting the Wright Brothers, and on his return to England in 1908 he at once commenced experiments in flying. Mr. Blackburn is indeed a born "hustler," for he actually designed, constructed, and piloted his first machine all within a few months of his return from Paris.

It was on Saltburn Sands in North Yorkshire that he made his first flight, and, in the face of much scepticism, and at considerable personal risk, he triumphantly demonstrated the flying powers of this, the earliest type of Blackburn aeroplane. His next enterprise was to start a business for manufacturing aeroplanes on a small scale, and from this nucleus the great Blackburn Aeroplane and Motor Co. eventually developed. The company's headquarters are at Brough, near Hull, East Yorks, where the experimental factory, production shops, aerodrome, and seaplane base are situated.

Needless to say, Mr. Blackburn in those early days encountered much opposition from short-sighted friends, and the success of the company is almost entirely due to his prescience and persistence. He has conducted the business from its inception as an entirely personal affair, and still exercises a controlling interest in the present-day company.

In the years before the war Mr. Blackburn produced a number of exceedingly good aeroplanes which made history in the early days of aviation. One of his machines was the first to fly across the Bristol Channel. The late Captain B. C. Hucks learnt to fly on a Blackburn Monoplane, known as the "Mercury." This machine was entered for the "All Round Britain" flight in 1911, and, after putting up a remarkably good performance, had the misfortune to land on a barbed wire fence which damaged it considerably. Although repairs were rapidly carried through, the pilot considered he had no further opportunity of winning the race and accordingly flew back to the company's hangar. As a further example of Mr. Blackburn's enterprise, it is worth recording that in 1911 he built one of the first, if not the first, successful all-metal aeroplanes in this country. This machine was a two-seater military monoplane, built almost entirely of round and oval section steel tubing, and its construction was based on very similar principles to those in use to-day on the most modern types of all-metal aircraft.

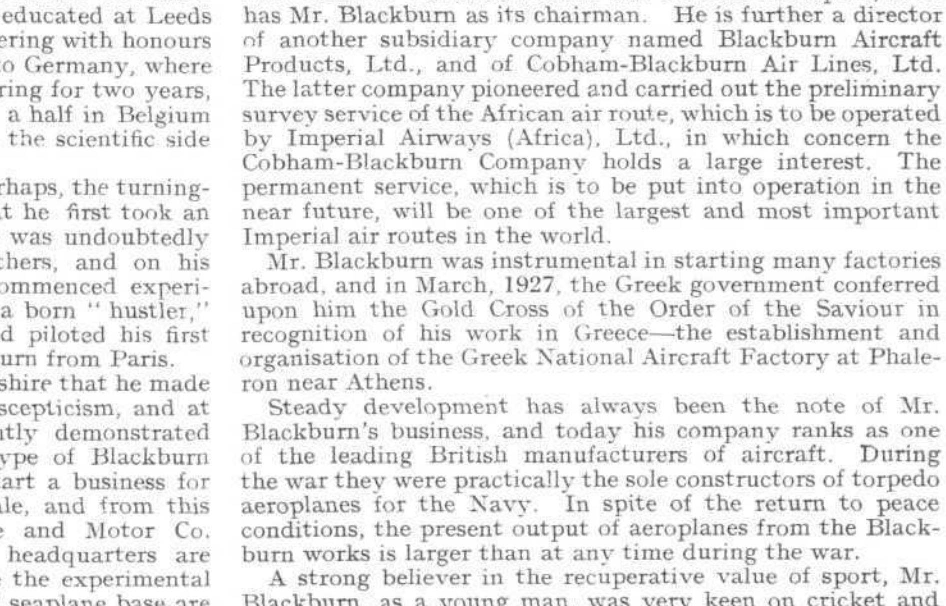
It was in 1912 that Mr. Blackburn started a private company for building aeroplanes, and he made such progress that by 1914, on the outbreak of the Great War, he was fairly well prepared to take a very large share of the work necessary to supply aircraft for sea and land fighting. The actual part taken by the Blackburn Co. in the war is now a matter of history. Subsequently, Mr. Blackburn has more largely developed the construction of aeroplanes and flying-boats for commercial purposes.

There is also a subsidiary company, likewise controlled by Mr. Blackburn, which he founded to promote air transport as distinct from the manufacturing side. This company, known as the North Sea Aerial and General Transport, Ltd. has Mr. Blackburn as its chairman. He is further a director of another subsidiary company named Blackburn Aircraft Products, Ltd., and of Cobham-Blackburn Air Lines, Ltd. The latter company pioneered and carried out the preliminary survey service of the African air route, which is to be operated by Imperial Airways (Africa), Ltd., in which concern the Cobham-Blackburn Company holds a large interest. The permanent service, which is to be put into operation in the near future, will be one of the largest and most important Imperial air routes in the world.

Mr. Blackburn was instrumental in starting many factories abroad, and in March, 1927, the Greek government conferred upon him the Gold Cross of the Order of the Saviour in recognition of his work in Greece—the establishment and organisation of the Greek National Aircraft Factory at Phaleron near Athens.

Steady development has always been the note of Mr. Blackburn's business, and today his company ranks as one of the leading British manufacturers of aircraft. During the war they were practically the sole constructors of torpedo aeroplanes for the Navy. In spite of the return to peace conditions, the present output of aeroplanes from the Blackburn works is larger than at any time during the war.

A strong believer in the recuperative value of sport, Mr. Blackburn, as a young man, was very keen on cricket and football, but it is riding which has always been his favourite form of exercise. Hunting is in consequence practically the only field sport in which he takes an active part today, and



The first Blackburn Machine: This monoplane was designed, built and flown by Mr. Robert Blackburn at Saltburn in 1909. The machine is here seen on the sands.

as his residence lies in the Bramham Moor country he takes every opportunity his business allows of a run with that famous pack. He is also an occasional follower of the York and Ainstry Foxhounds.

Mr. Blackburn was one of the first Yorkshiremen to take to motoring and drove one of the first cars to be introduced to Leeds. He is a member of the Royal Aero Club and the Royal Automobile Club, and resides at Bowcliffe, Boston Spa, Yorkshire.

At the staff dinner, which was attended by more than 250 people, Mr. H. Milnes, assistant works manager, took the chair, and after the loyal toast he said he did not wish to encroach on the ground to be covered by the many speakers who were to follow, but he would call attention to the fact that they had met to honour their managing director, Mr. Robert Blackburn, and to show him exactly what they thought of him on his completion of 21 years in aviation. He called upon Mr. McCulloch, chief inspector, to propose the toast "Our Guest of Honour."

Mr. McCulloch recalled that in 1909 Mr. Blackburn designed, built and flew his first machine, all within the space of a few months. On the very first attempt the machine left the ground, and Mr. Blackburn made a straight flight of some hundreds of yards. In these modern times that did not appear to be anything remarkable, but, remembering the short time Mr. Blackburn had taken over it all, it was a very remarkable achievement. He was not sure whether Mr. Blackburn had submitted any claim to being the first British aviator to make a flight in the British Isles, but he was fairly certain that Mr. Blackburn's first flight ante-dated the flight of Col. Moore-Brabazon's officially-recognised flight of April 30, 1909. Mr. Blackburn had never been good at blowing his own trumpet, and his poor performance on that instrument had doubtless deprived him of much deserved recognition.

The first Blackburn machine came to grief when Mr. Blackburn attempted to make a turn. He at once set to work to build another, and on that second Blackburn machine, which must be counted a success by the standards of that time, Mr. B. C. Hucks learned to fly, and on it he took his ticket. Ultimately the second machine came to grief, and gave Mr. Blackburn another nasty jar. One cannot, however, keep a good man down, and in a few months' time Mr. Blackburn bobbed up again with more aeroplanes, this time fitted with the "Gnome" rotary engine. It was on one of these machines that Mr. B. C. Hucks gave the remarkable series of flying demonstrations in various parts of the country. Among other pilots who flew those early Blackburn monoplanes was Mr. (now Wing Commander) Harold Blackburn, who very fittingly was with them that evening. (Wing Commander Blackburn is not related to Mr. Robert Blackburn, although the identity of names has led many to believe that he is.—ED.)

Early in 1914 Mr. Blackburn received his first order from the Government, an order for a few B.E.2C machines. Again he showed his courage, foresight and faith in aviation by taking over the huge skating rink at Olympia, Leeds. There, with a few men, he took off his coat and started to make B.E.2C's. Thus, when war broke out, Mr. Blackburn was prepared for aircraft production on a fairly large scale. About that time Mr. Blackburn turned his attention to seaplanes, and the need for a suitable base from which these could be operated arose. One of Mr. Blackburn's early henchmen, one Mark Swann, was turned loose to search the banks of the Humber for a suitable base. Mark set forth unarmed, except for his bow and arrows, and after many adventures he eventually planted his feet at Brough, after having made judicious enquiries concerning the quality of the beer in the neighbourhood. And thus Brough came into being.

Mr. McCulloch recalled that the Blackburn company came into being in 1914, and that among the types of aircraft produced were the "Kangaroo," which did excellent submarine spotting in the North Sea during the war; the "Cuckoo," which was the first successful torpedo-carrying aircraft; the "Dart," which for many years was the adopted type of torpedo-carrying aircraft of the Fleet Air Arm; the "Ripon," its modern successor; and finally the "Iris" flying-boat which, when first produced, was the largest and fastest flying-boat in the world.

Mr. McCulloch concluded by asking Mr. Blackburn to accept a cocktail cabinet, to which had subscribed the directors and staff of the Blackburn company and of the North Sea company.

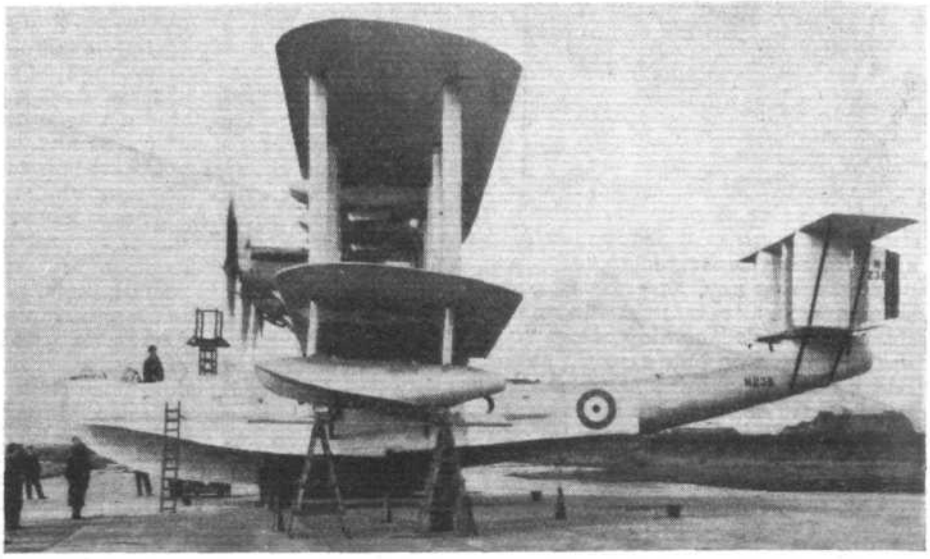
Mr. Robert Blackburn, in responding to the toast, said that the evening's "do" had been kept a secret from him until a few days previously, and he was just beginning to realise what a marvellous woman his wife was—she had known of it for weeks without telling him! He would like to pay a tribute to those who were colleagues and associates of his in the early days, and who gave him encouragement and sympathy. First of all he desired to pay a tribute to his father and mother. They gave him the very best education in their power, and sent him to work at the bench at 6 in the morning and then, when he had enough of that, they allowed him to go to the Northern University, where, under Prof. Goodman, he spent three of the finest years of his life. Referring to his early engineering career abroad, Mr. Blackburn recalled that while he was with an engineering firm at Rouen he used to ask the Friday or Saturday off so as to go to Paris to watch flying at Issy. These week-end visits gradually got longer and longer, and finally, one Tuesday, when he was very ashamed of himself and knew he would "get the sack," he got the first word in with his employer and gave notice. He then went to live in Paris and began to design his first machine. His father and mother arrived unexpectedly, and he managed to persuade them to go with him to the first Paris aeroplane show. They said, "Well, if you like it and want to be a fool, go ahead!" The result was that Robert stayed in Paris and finished the designs for his first aeroplane. He then came home, and tried to build the machine in his father's works, but it interfered with production and he was turned out. He then took a small place in Clifton Street, and there his first machine was finished.

Mr. Blackburn, after recalling some of his early trials and tribulations, paid a tribute to men like Hucks, Blackburn, Christie, Glew and Buss, and to his brother Norman Blackburn. These were the men, he said, who did the hard work, and who enabled him to prove that flying was not as dangerous as most people thought. To the mechanics who worked with him, and for him, in those early days, Mr. Blackburn also paid a warm tribute—Harry Goodyear, Mark Swann, Arthur Mason and George Watson.

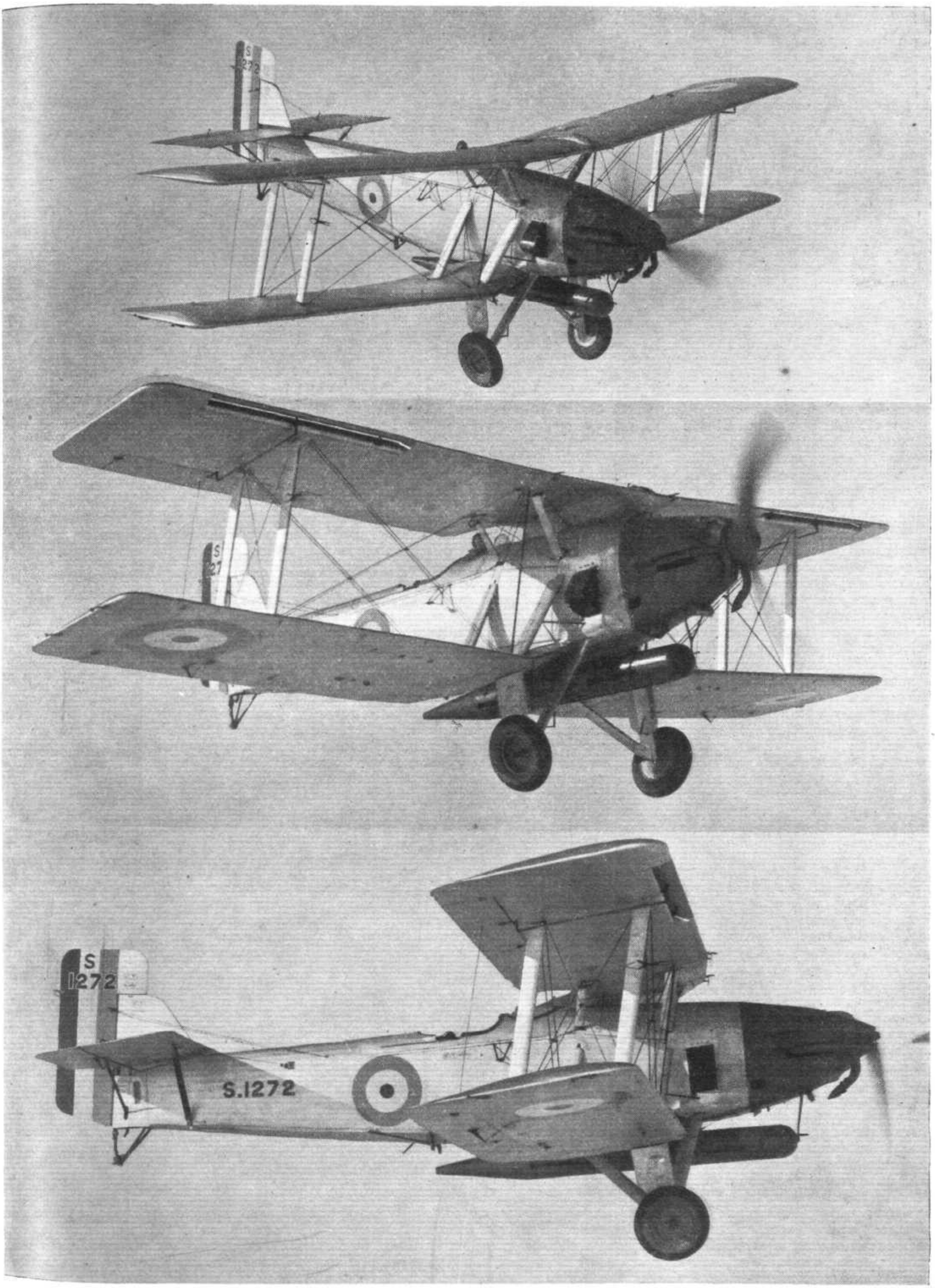
Miss Daisy Smith, the oldest lady member of the staff, then presented a bouquet to Mrs. Robert Blackburn.

Capt. Norman Blackburn proposed the toast of "The Ladies," to which Miss Lees responded.

Maj. Rennie, Blackburn's chief seaplane designer, proposed the toast of "The Air Ministry, and Mr. Charles Blackburn, sales manager, "The Visitors." This toast was responded to by Mr. Chapman, of the Sheffield firm of Jessop & Son, steel manufacturers.



The Blackburn "Iris III" Flying-Boat is of all-metal construction except for the wing covering.



THE LATEST BLACKBURN MACHINE : Three aerial views of the all-metal "Ripon" Torpedoplane.

(Flight *Photographs.*)

Mrs. Blackburn has helped her sons (Robert, Charles and Norman) a great deal with advice and encouragement. Although she is 66 she enjoys a flight.

Mr. Metcalfe, chief draughtsman, proposed "The Prosperity of the Blackburn and North Sea Companies," to which Mr. Hudson, a director and secretary, responded.

Mr. Meeson, who was to have proposed, "The Resident Government Officials," was indisposed, and the toast was instead proposed by Mr. Emsley, assistant chief draughtsman and responded to by Mr. Murray, resident technical officer.

The toast of "The Staff" was proposed by Mr. Rhodes, a director and London representative, and was responded to by Mr. Leary of the Records Department.

During the evening a presentation took place of silver cigarette cases to Mr. Mark Swann, of the inspection department, the oldest member of the staff; to Mr. Arthur Mason, foreman of the erecting department; to Mr. George Watson, foreman of the experimental erecting department, all old members of the staff, in recognition of their long service and excellent work.

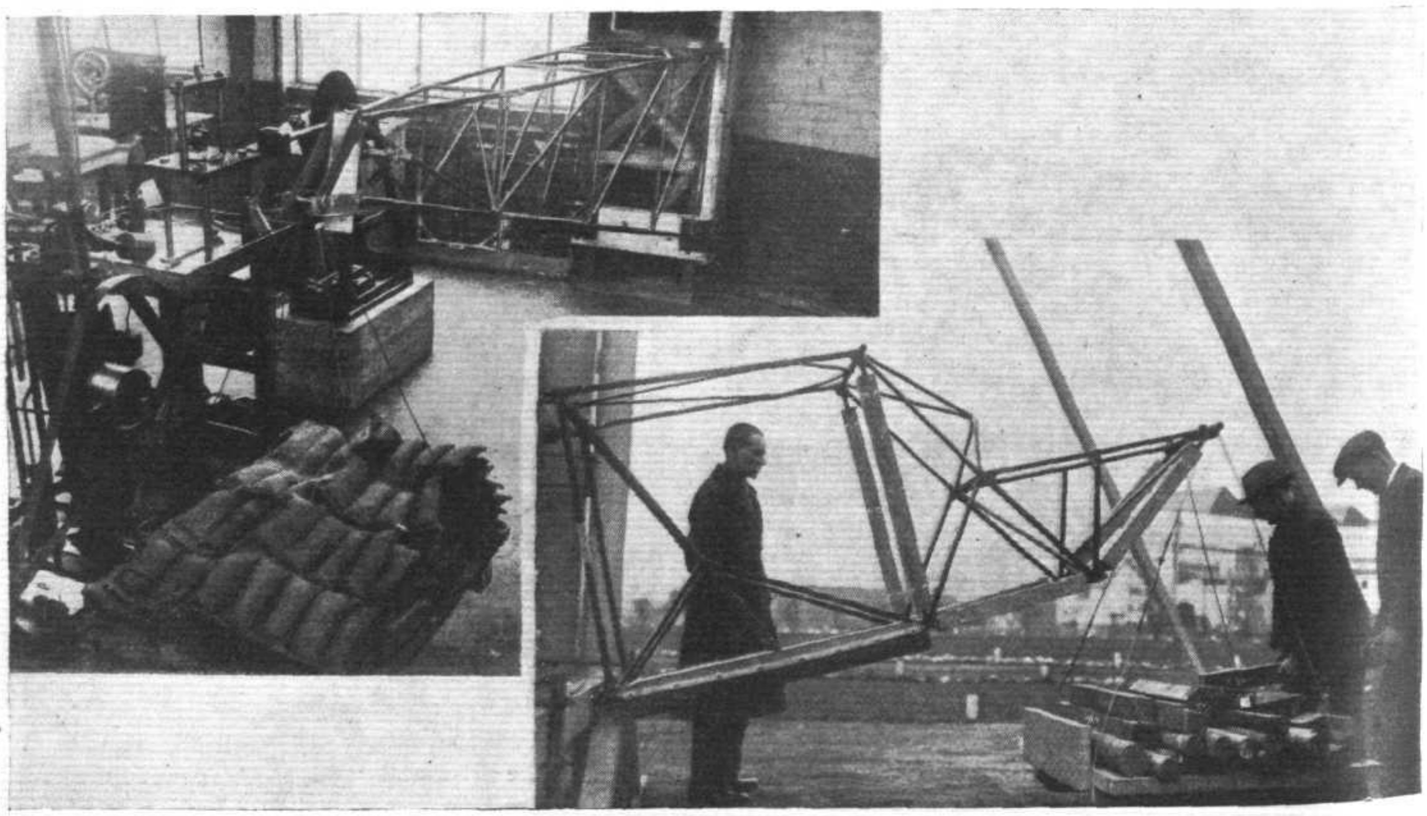
In addition to those whose names have already been mentioned, there were present, among others, Mrs. K. Blackburn (mother of the Blackburn brothers), Capt. and Mrs. Fletcher, Capt. Wybrow, Maj. Purves, Mr. and Mrs. Lane (all of the Air Ministry), Capt. and Mrs. Ayre, and Capt. Andrews (of National Flying Services), Sqdn.-Ldr. Noakes and Mr. George Allen.

The staff dinner was followed by a dance, at which everyone thoroughly enjoyed him/her-self in a manner that indicated that whatever may be the case with the rest of England, Yorkshire folk do not take their pleasures sadly.

AIR EXERCISES, 1930

THE *Daily Telegraph* air correspondent published the following on February 25. The Air Ministry declines to make any statement on the subject, but we have reason to believe the passage is substantially correct. It runs:—"A departure in the exercises of the Royal Air Force is to be made this summer. In 1927 and 1928 the manœuvres were devised to test the defences of London against air raids. This year the exercises are being planned with a view to testing certain theories relating to the danger to Empire trade routes from hostile surface aircraft, and to the functions of special defending aircraft. Coastal aircraft will be largely employed, and the new fighter and day bomber types with which the R.A.F. is being equipped will play a very small part.

There will be one notable feature of this year's exercises. For the first time in the history of the Royal Air Force the big flying-boats will be employed on operations more or less public and of a highly important and deeply interesting character. I understand that there will be a big concentration of these craft on the south coast, probably at Calshot, and another on the east coast. Other types used will be coastal reconnaissance and torpedo craft. It is expected for that purpose that the Fleet air arm, which consists of aircraft carried aboard ship, either aircraft-carriers or on battleships or cruisers, will co-operate. The plan of operations will, I understand, provide for a scientific and realistic test over a limited area. The results will be elucidatory as regards Empire trade routes in all parts."



THOROUGHNESS: Proof loading the "Moth III" fuselage. Above, the rear fuselage loaded to 8,500 lbs., and below, the engine mounting with 2 tons suspended from it. (Flight *Photos.*)

TEN YEARS' GLIDING AND SOARING IN GERMANY

By PROFESSOR DR. WALTER GEORGII of Darmstadt

A lecture delivered before the Royal Aeronautical Society on Wednesday, February 19, 1930.

BEFORE passing to the subject of the paper may I ask your indulgence for my limited knowledge of English, which prevents my giving a free discourse, and constrains me to a set lecture. This I view with regret since it makes it difficult to impart to my words the lively and vivid feeling which a more formal picture of the importance and attractiveness of gliding flight may not give.

We are looking back on ten years of development and on an unbroken series of ten gliding competitions held at the Wasserkuppe in the Rhön, since 1920.

The organisation has not only maintained its range of activities all these years, but has largely extended it, and in this way has given the best proof of its vitality and purpose.

In the first decade, now completed, successes have been achieved such as few foresaw, and the cause may be sought in the spirit of close co-operation with which the sportsman strove to avail himself of the flying possibilities opened up by the scientist.

This union of sport and science is in the true tradition of German gliding since its revival in 1920. At Frankfort in that year, Oskar Ursinus directed the " air-minded " members of the younger generation towards gliding as a substitute for power flight of which they were perforce deprived ; but he had the progress of aeronautical science at least as much at heart as the interest of the sport. He desired to direct aeronautical investigation along a new path, and to free it from the restricted view that progress was bound up with power flight. Were it possible to develop gliders carrying appreciable loads, they would serve as prototypes for light aeroplanes, without losing sight of more general sporting possibilities. The evolution of the light sporting aeroplane from the glider was his technical objective. His sporting aim was to offer keen youngsters a chance of flying at no great financial outlay by giving their time freely to constructing gliders. In the course of their purely sporting activities they would develop a sound team spirit and would find a stimulus to technical and scientific work.

On his initiative the first gliding competition at the Wasserkuppe in the Rhön was held in August, 1920. In spite of initial difficulties a new gliding record of 2 mins. 22 secs. and 1,830 m., was made by W. Klemperer, whose design first settled the type of construction suitable for gliders. It was a cantilever low-wing monoplane, in which great care was given to keep down resistance with its adverse effect on performance.

In the following year the same principle of keeping down body resistance was more fully applied by G. Madelung to his glider " Vampyr."

The " Vampyr " type prevails at the present time, and this is a measure of Madelung's contribution to glider design.

Since gliding flight depends on the use of slowly rising currents in the air, a practicable glider is chiefly characterised by a small vertical component of velocity, or rate of descent.

A small rate of descent may be obtained either by reducing the sum of the resistances or by reducing the wing loading. These two methods have been applied, and lead to two special types of glider, both of which find application for special purposes. A large span and good aspect ratio are favourable to a small (induced) resistance, and further reduction of resistance is gained by a closed body, cantilever construction (no external bracing) and by dropping the starting carriage.

From the " Vampyr," the prototype of German high performance gliders, onwards, all these methods of reducing resistance have been so carefully studied and carried out that further fundamental improvements are scarcely to be expected.

The following are the best known German high performance gliders from the " Vampyr " of 1921 to the " Wien " of 1929:

" Vampyr "—Academical Flying Club of Hanover, **1921.**
" Consul "—Academical Flying Club of Darmstadt, **1923.**
" München "—Academical Flying Club of Munich, **1928.**
" Wien "—R. Kronfeld. Built by A. Lippisch, **1929.**

On the " Wien," Kronfeld carried out his great duration flights, covering distances up to 150 km.

In designing for low head resistance the structural weight is increased to a restricted degree, and the structural methods, illustrated above, produce medium heavy gliders with a margin of strength for high performance and for flying in gusty weather. The additional weight gives the greater air speed required for progress against strong winds and for passing rapidly through unfavourable belts of down winds.

The glider of low resistance and considerable structural weight is the best all round for long cross-country glides by virtue of its slow descent and high air speed.

Another method of reducing the rate of descent, by reducing the wing loading, is widely applied to glider design but is quite unsuitable for high performance. It produces a very special type of low air speed, poor gliding angle, light structural weight and simple form.

The Djalvar—" Anamma " (" Devil take it ") is of this type and its main characteristics are : braced monoplane wings, single girder, tail boom and boat-shaped cockpit below the wings.

It has a good duration performance in light winds but a restricted range on account of its slow air speed. In the school type, the aerodynamical qualities are sacrificed to more robust construction, simplified for ease of repair ; the cockpit is not covered so that the pilot may fall clear in a smash, and restricted gliding and soaring powers are desirable for training purposes. The best known of this derived type is the " Zögling,".

Once the principles of succesful soaring were recognised results, soon followed.

In 1922, Hentzen and Martens, both students, carried out the first soaring flights, lasting over an hour, on the "Vampyr." Hentzen's record flight of 3 hrs. 10 mins. attaining an altitude of 350 m., made the activities at the Wasserkuppe world-famous. It elucidated the problem of soaring flight by using the energy in the air's motion.

In accordance with the laws of motion soaring is possible in an ascending current of ar, and in a horizontal air current of variable velocity. When the rate of ascent of the air current equals or exceeds the rate of descent of the slides " static soaring " is possible.

A PROFESSOR TYPE : The " Wien "

When the horizontal wind is variable, the pilot gains height as the velocity increases and loses height as the velocity decreases. As the air forces are proportional to the square of the air speed, it is possible in principle to obtain a net gain. If the net rate of gain equals or exceeds the rate of descent this " dynamic flight " becomes possible. It is quite probable that some dynamic gain was obtained in the earlier flights, but not by any systematic use of the wind fluctuations.

The extensive efforts made from 1921 to 1923 to connect pulsating dynamical effects with the performance of man-carrying gliders did more harm than good to the development and reputation of soaring, the possibilities of which, apart from any such effects, have been fully shown by the subsequent years.

To revert to static soaring, local rising currents are produced by every irregularity of the earth's surface—knolls, dunes, woods, the waves of the sea—and may be utilised for soaring flight.

The following photographs show well-known soaring grounds :—

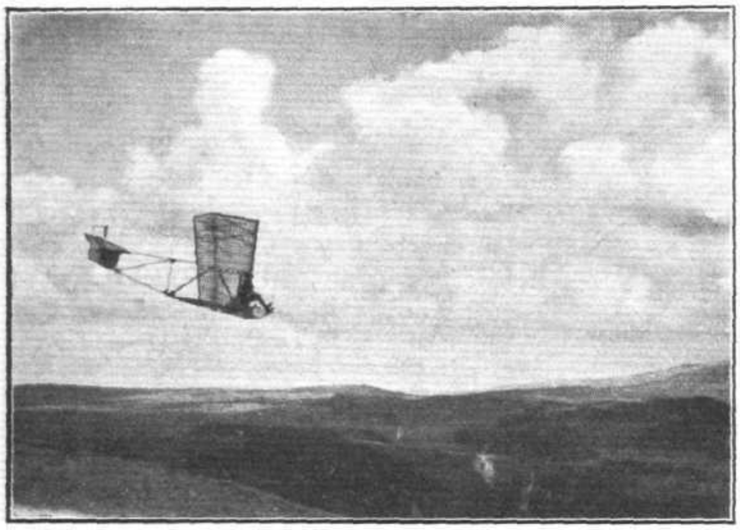
The Wasserkuppe in the Rhön.

The soaring grounds at Rossitten on the Kurisch lagoon (at the mouth of the Memel in East Prussia).

The following table shows a number of duration records :—

	1922	1928	1929
WASSERKUPPE			
Year	1922	1928	1929
Pilot	Hertzen.	Kronfeld.	Neininger
Duration ..	3 hrs. 10m.	7 hrs. 24 m.	8 hrs. 24 m.
ROSSITTEN			
Year	1924	1925	1929
Pilot	Schulz.	Schulz.	Dinort.
Duration ..	8 hrs. 24 m.	14 hrs. 7 m.	14 hrs. 43 m.

It is seen that the records at the Wasserkuppe have dropped far behind those at Rossitten. Such flights are a useful



THE INSTRUCTIONAL TYPE: A Zögling glider

stimulus to the sport, but do not much help further developments of soaring. For this reason, cross-country flights have been preferred at the Wasserkuppe as eminently serviceable for research work, and by this means alone new regions of favourable rising winds have been delimited, and the practice of soaring has been made less dependent on time and place. The performance has been steadily improved and a high aeronautical and scientific standard of instruction in the methods of soaring has been attained. The following table shows the progress made since 1922 with cross-country soaring flights :—

Year	Pilot	Distance in km.	District
1922 ..	Martens ..	9·5	Wasserkuppe.
1923 ..	Botsch.. ..	19·0	,,
1925 ..	Nehring ..	21·0	,,
1927 ..	Nehring ..	52·0	,,
1928 ..	Schulz ..	62·0	Rossitten.
1929 ..	Nehring ..	72·3	Odenwald.
1929 ..	Kronfeld ..	100·0	Teutoburger Wald.

The technique of cross-country soaring flights is best shown by plotting the course on a contour map, with barogram readings of the heights attained, and other information supplied by the pilot.

In the flight round the Heidelstein, Nehring first soared over the south slope of the Wasserkuppe until he had gained 150 m. height above the starting point. He then flew parallel to the ridge and at right angles to the prevailing wind to Münzkopf, where he used the strong up-current to reach his maximum height at 260 m., which was sufficient to reach the Heidelstein and return to the starting point.

Hirth's flight was more difficult and more instructive. He started from the west slope of the Wasserkuppe, and maintained himself there until he had gained 400 m. in height, and then carried out his cross-country flight to the immediate neighbourhood of the Schweinsberg without serious difficulty. On the return flight he found that he had lost height badly, and was 200 m. below the starting point. He was twice forced to turn back and soar over valleys with up-winds in order to regain sufficient height to regain the western slope, over which he cruised until he was high enough to land on the plateau of the Wasserkuppe at the prescribed point.

In this admirable exhibition of the methods of cross-country work, it is seen that the pilot leaves the original region and seeks new areas of rising wind, leaving nothing to chance, but laying his course beforehand, according to the wind prevailing and to the lie of the land. It is characteristic of such flights that the best course is not in general the shortest distance, but may involve long detours in reaching up-wind areas, and lengthy soaring over a particular point in gaining sufficient height. Briefly, the pilot must fly on sound topographical and meteorological information, if he is to reach his goal. Cross-country flights will be achieved over wide regions by flying from slope to slope, from hill to hill, and finally, from range to range. The satisfaction of skilfully adapting soaring flight to the configuration of wind currents and landscape is enhanced if need be by the sporting excitement and by the real value to flying.

Nehring's flight of August 9, 1927, is another instructive example of cross-country work in which a whole range was traversed by passing from hill to hill. There was no straightforward continuous region of upwinds available. Local areas of rising wind had to be sought out on slopes facing the general direction of the wind, and wide belts of downwind lying between them had to be crossed. The tactics adopted were circling over hills which produced rising winds, long enough to gain extra height for the next stage of the flight.

Kronfeld's 100-km. flight in spring, 1929, over the Teutoburgerwald was achieved by these same tactics, and supports the view that a sound knowledge of the flow of the wind round hill ranges, hills, knolls and dunes enables a soaring pilot, competent in his art, to achieve remarkable cross-country performances, over hill and dale.

We cannot remain content to restrict soaring to hilly country but must strive to bring within its scope the regions of the air above flat lands. The sailing flight of birds, indeed, shows that upwinds exist over plains, and are probably adaptable to soaring man-flight.

Research on soaring was initiated just at the beginning of the serious crisis of 1924 and 1925.

Soaring gliders had not been involved in the restrictions imposed on power aircraft, but were adversely affected by the revival of interest in the sporting possibilities left open to light aeroplanes, when the worst restrictions were removed.

After the record duration soaring flights of 1922 England, France, Italy and Russia had held soaring competitions, but interest had soon passed back to the light aeroplane. Even in Germany soaring came to be regarded as a mere makeshift for power gliding. Only when this erroneous view had been disproved, and soaring shown to have its own individual scope, did the crisis pass.

The Rhön-Rossitten Gesellschaft was founded in these difficult times, with the purpose of supporting gliding schools, of holding competitions to give publicity, of improving performance, and of stimulating gliding activities generally. A special research department was established at the Wasserkuppe for advancing technical and scientific knowledge of the problems involved, and the management was placed in the hands of the present author in 1926.

The Rhön-Rossitten Gesellschaft may be regarded as the centre of the gliding movement in Germany and in other countries. Teams were sent to the meetings in the Crimea at Asiago and at Vauville. Instructors were sent to the United States on the formation of the American gliding school at Cape Cod. A French educational commission has received full training, and this has stimulated the sport in France. Technical advice has been given to Hungary, Holland and Belgium. In these ways the Society has made its contribution to the common problem of soaring flight to which in turn all other nations can contribute their activities. Since 1926, having overcome the crisis of 1924-25, the practice of soaring and gliding has made vigorous and continuous progress. Glider schools have been established, and standard gliders have been distributed along with working drawings and instructions for building them. These include the "Zögling," "Prüfling" and "Professor" types. The number of air-minded youngsters and their interest in gliding have been increased by these measures, and above all, research has opened out new possibilities and has contradicted the prevailing belief that soaring depends entirely on the use of rising current over hill slopes.

The investigations of rising currents in the free atmosphere carried out in the last few years at Darmstadt and at the Wasserkuppe have shown that soaring under cumulus clouds and near cold fronts is practicable, both entirely new conditions.

It has long been known that cumulus clouds are associated with rising currents of air, but few measurements were available. Research was directed to the determination of these currents in the Spring of 1928 from measurements of the vertical rate of a power plane gliding beneath a cumulus

cloud with its airscrew stopped. Repeated glides of as long as 10 mins. without loss of height were obtained.

A "cold front" produced a line squall of moderate intensity, and the aeroplane, with airscrew stopped, maintained itself without loss of height for 15 mins. From these results it was inferred that a soaring glider starting from the Wasserkuppe could reach the region of rising currents under a cumulus cloud or the front of an approaching squall, and this was successfully accomplished in a soaring flight by the "Darmstadt," August 10, 1928.

The "Darmstadt" maintained itself over the west slope of the Wasserkuppe at 100 m. above the starting point. In 20 mins. the boundary of the up current below an approaching cloud was reached, and the glider was quickly carried up to a height of 400 m.

Kronfeld, in a flight at the Himmeldankberg, August, 1928, started from the western slope of the Wasserkuppe, and flew at once towards an approaching cumulus cloud, which he followed towards the east with continual gain of height, reaching finally 470 m. above the starting point. The cloud began to dissipate and the up current became ineffective, so that Kronfeld left it and flew with considerable loss of height to the Himmeldankberg as pre-arranged, and there soared for some time in the up currents. On the approach of another cumulus cloud Kronfeld used it to gain considerable height, and then flying always from cloud to cloud he reached the Wasserkuppe at his maximum height of 540 m. above the starting point.

These details illustrate the difference between hill and cloud flying, between flying from hill to hill over a course, which must be adjusted to the contours of the ground, and flying from cloud to cloud over hill and plain, when the ground is ignored and the pilot scans the cloud formations and adjusts his course to their motion.

Gröenhoff, in a flight with a passenger on the two-seater "Rhönadler" on July 30, 1929, extended the performance obtained by flying into the cloud instead of soaring below it. Gröenhoff started from the west slope of the Wasserkuppe and soared over it for a short time, then flew under a cumulus cloud and rose through it almost to its summit, reaching a maximum height of 1,250 m. above the starting point, and covering a course of 33·3 km., both figures being records for soaring flight with a passenger.

The rate of descent of the glider in still air was 1·1 m./sec., from which the vigour of the up winds may be inferred.

Severe vertical gusts were met with in the cloud. At 1,800 m. the glider was driven down 140 m. in a few seconds, and immediately after it was carried up 170 m. Two more such gusts followed after. The reduction gives a down current of 9 m./sec. and an up current of 10 m./sec.

On the same day and under the same weather conditions Kronfeld made his great cross-country flight of 150 km. from the Wasserkuppe to Bayreuth.

Immediately after the start Kronfeld flew under a cumulus cloud, and was carried up continuously to a height 2,150 m. above the starting point.

The up current given by the measurements was 5 m./sec. After leaving the cloud height was slowly lost in passing over flat country. In two hours the Thüringenwald was reached, and the flight was continued for 4 hours in the rising currents from the ridges. Finally a landing was made at the Fichtelgebirge 150 km. from the Wasserkuppe.

This masterly flight is a fine example of the art of soaring, and illustrates the manner of utilising the various means available. In particular a record height in this manner was gained in the up current of a cumulus cloud formation sufficient to cross flat and hilly country alike, independently of the consideration of the surface.

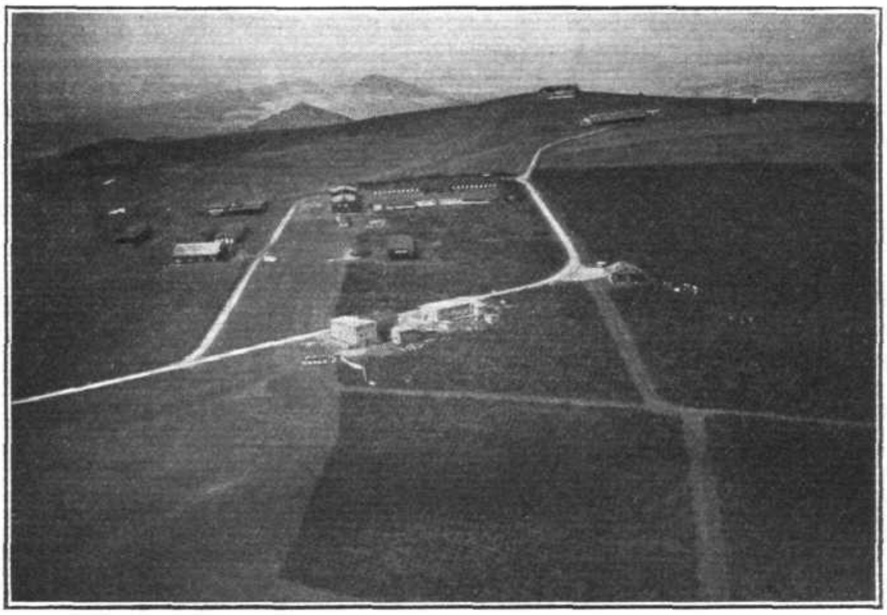
The most important result is the ease with which great heights can be reached in the up currents of cumulus cloud formations. The second part of the flight gives fresh evidence of the value of the older established method of flying in the up currents from hills.

A more recent development of cloud flying is the use of up currents at the cold air fronts of line squalls, of which measurements with an engined aeroplane have been referred to. In this type of atmospheric disturbance masses of warm air are pushed up by the inrush of cold air along the surface of the earth.

In front of the line squall the air rises almost vertically and offers the best soaring region.

Kronfeld, in another flight, started at the moment when the wind was freshening, just before the passage of the line squall, and by utilising the rising currents, before the cold rose 2,000 m. above the starting point. The middle part of the barogram shows that he then maintained steady flight.

The meteorological records determine the motion of the storm accurately, and, in conjunction with the pilot's account, lead to the conclusion that he flew about 2 km. before the front of the squall, rising or falling slightly as he was nearer or farther.



THE HUB OF GERMAN GLIDING; The gliding station at the Wasserkuppe in the Rhön District

After turning away from the front, the glider rapidly lost height and landed 143 km. from the Wasserkuppe after 4½ hours' flight.

The knowledge gained as to the configuration of line squalls, leads to the conclusion that there is no danger if the pilot keeps some distance before the advancing front.

It appears from recent investigations at the Research Institute of the Rhön-Rossitten Gesellschaft that heights of 4,000 m. to 4,500 m. above the starting point may well be attained, in comparison with the existing record of 2,150, and that the cross-country record of 150 km. may be increased in like proportion.

Systematic experiments have been carried out by the Society with gliders towed by power aeroplanes and released at a sufficient height to reach regions of up-currents and to continue independent cloud flying.

The Prospects of Soaring Flying

The performances recorded above show that flying without engine power, by using the energy of rising currents in the atmosphere is already established. We cannot, indeed, expect it to meet the requirements of air transport, but its value as a sport cannot be questioned, and as such is on a high level in its demand for physical fitness, skill, quick decision and courage, and, in addition, a serious study of the scientific and technical problems involved.

Especially, soaring flight has had a beneficial effect on the design of light aeroplanes which now give performances with low engine power which were possible formerly with powerful engines.

The soaring glider with an auxiliary engine is unsatisfactory both as a glider and as a power aeroplane, and this line of development has been given up in Germany except for special research work.

The Research Institute of the Society has recently established a new and important system of aerodynamical tests of new aircraft types. In the first place free flights by large models of 3 to 4 m. span are carried out at small cost. When all that can be learned from the models has been recorded, gliders of similar aerodynamical form are built and tested by a pilot in different flying altitudes. Finally, an engine is fitted and ordinary flying tests are carried out.

(To be continued)

CORRESPONDENCE

The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.]

OBSERVING AIR FLOW ROUND MODELS

[**2280**] Your correspondent D. De Guérin [2260] might find a satisfactory solution with a wind tunnel with a glass side and powered with a fan *pulling* the air through it. With the model in flying position—sprinkle powdered chalk in front of the tunnel. This will adhere behind the bumps on the body etc., if the chalk is fine enough. This is a rather messy method unless the end of the tunnel is out of a window. With the glass window one can observe the flow quite well and still have the place plainly marked where the model needs trimming. Hoping this will be of help.

C. W. U.

Toronto, Ont., Canada.
Jan. 28, 1929.

AIR ACCIDENTS

[**2281**] In the unfortunate accidents which, from time to time, overtake aircraft, there is one salient feature which strikes anyone who gives these sad matters any attention, and that is the resulting fire which—as in the latest Air Union crash—is responsible for increased loss of life. It is always the ignition of the petrol that causes the fire.

What I wish to suggest is, that the petrol tanks should be so mounted, that, by the operation of a lever, they would become instantly disconnected from the aeroplane, and fall clear of it.

Tanks on or under the wings might be mounted on slanting runners, so that, on pulling the lever, they would slide outwards and backwards to the trailing edge, from whence they would drop clear of the machine. If necessary, a small tank containing enough fuel for about 2 mins. could be kept, which would not be very dangerous.

I should be very interested to know if anything of this nature has been thought of before, and would like to hear the views of some of your other readers.

G. D. Everington.

Sanderstead, Surrey.
February 17, 1930.

FLYING SCALE MODELS

[**2282**] With reference to Mr. D. M. Edwardes' description of his scale flying model of the Hawker "Hornet," published in the February 14 issue of Flight, may I request Mr. Edwardes, through you, to give a few more particulars of this very interesting model.

What, for example, are the airscrew diameter pitch and maximum blade width, and how do these figures compare with those of a true scale airscrew as used on the Hawker "Hornet" machine? Mr. Edwardes mentions a rubber motor of three skeins of 10 strands geared together. What is the length between hooks of the motor and what is the actual unstretched length of the skeins and total weight of rubber? From these particulars it would be interesting to make a comparison between the horse-power required to fly the real machine and the model, though, of course, we should have to know the number of turns to which the motor is normally wound and the duration of motor in flight. If any figures are available as to propellor thrust and efficiency they would be most valuable in extending the comparison. Can Mr. Edwardes also give a detailed weight analysis of the model in flying trim?

I notice that Mr. Edwardes mentions the necessity for allowing for "liberal angle of incidence" on the tail plane. Does he refer to positive or negative incidence, and, if the former, would not this upset the longitudinal stability of the model?

Another point of importance is the wing section employed. Mr. Edwardes refers to a high lift section but does not give any details. In view of the fact that the planes on the model are probably operating at considerably lower LV figures than those on the full-size machine, it would be instructive to know whether the true scale section would suffice or whether an alteration to this point is necessary.

From the photos it would not appear that a particularly thick section is used—something like the R.A.F. 28, with max. K_L of $0\cdot492$, $\left(\frac{K_L}{K_D}\right)$ $22\cdot0$ max., and max. thickness $0\cdot098$ c. would appear feasible for a model of this type and size. But I should appreciate Mr. Edwardes' views on the subject.

In conclusion, I may state that I am at present engaged on a very similar model, taking the Fairey "Fox" day bomber as prototype, and multiplying dimensions of the general arrangement drawing (Flight, July 11, 1929) by ten. This gives a span of 32·8 in., and I am expecting the complete model to weigh slightly less than 10 ozs.

Thaxted, Essex. D. de Guérin.
February 15, 1930.

GLIDER CLUBS

[**2283**] I read in the current issue of Flight that gliding clubs are being formed at Gloucester and Evesham, may I, through your valuable paper, ask the organisers of these clubs the fees and conditions for joining, also if they intend building their own glider? as there are several fellows in Cheltenham who would like to join.

"Interested"

Cheltenham,
February, 1930.

CHEAPER FLYING

[**2284**] The letter [2276] to Flight this week leads us to suppose the writer has not heard of our "Swift" just put on the market. This 'plane, with a 40 h.p., A.B.C. Scorpion, has a cruising speed of 85-90 m.p.h., top speed of 105 m.p.h. and landing speed 35 m.p.h., with a range of 350 miles, and costs £400.

When folded the "Swift" occupies a span of 19 ft. by 7 ft. 6 in., and the petrol consumption is 40 m.p.g.

We shall be glad to hear from him further and arrange for a demonstration here at any time to suit his convenience.

For the Comper Aircraft Co., Ltd.
G. H. Dawson.

Hooton Park, Cheshire.
February 17, 1930.

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R.Ae.S. Lecture

A lecture will be delivered by Major F. M. Green and Mr. H. C. H. Townend on "The Resistance of Air-cooled Engines and the Townend Ring," on Thursday, March 6, at 6.30 p.m., in the Lecture Hall of the Royal Society of Arts, 18, John Street, Adelphi, W.C.2. The lecture will be fully illustrated and Mr. Townend will demonstrate with his ring to show its remarkable effect. Major Green will give figures to show the great decrease in the resistance of air-cooled engines, and the result of experiments which have been made during the past few years.

"Winged Flight"

"Winged Flight" is the title of a lecture to be given before the Society of Model Aeronautical Engineers by Mr. John D. Batten, M.A.LL.B., at the Y.M.A.C., Tottenham Court Road, W.C., on March 4.

Royal Air Force Club. Annual General Meeting

The Annual General Meeting of the Royal Air Force Club will take place at 5.30 p.m. on Wednesday, March 12.

Spanish-Dutch Air Convention

An Air Convention between Spain and Holland, regulating various points concerning aerial communications, has been signed in Madrid.

World's Records

The Royal Aero Club has been notified by the Fédération Aéronautique Internationale of the granting of the following world's records:—

Useful load; 500 kilos, France:—*Aircraft*—Breguet 19 special; motor; 600 h.p. Hispano Suiza. *Pilots*—Costes and Codes. *Place*—Istres. *Date*—January 17-18, 1930. *Performance*—Duration, 23 hrs. 22 mins.; distance 4,361 kms. 980 m. Speed over 2,000 kms., 214 kms. 553 m. per hour.

Light Aeroplanes, Two Seater, Italy:—*Aircraft*—Fiat A.S.1; motor, Fiat A.50. *Pilot*—Renato Donati. *Place*—Montecelio, Rome. *Date*—January 19-20, 1930. *Performance*—Duration, 29 hrs. 4 mins.; distance in a closed circuit, 2,746 kms. 200 m.

THE ROYAL AIR FORCE

London Gazette, February 11, 1930.

General Duties Branch

Pilot Officer on probation L. V. G. Barrow is confirmed in rank (Feb. 7); Pilot Officer J. M. Wells is promoted to rank of Flying Officer (Jan. 14); Wing Commander H. G. Smart, O.B.E., D.F.C., A.F.C., ceases to be seconded for duty with Royal Australian Air Force (Feb. 5); Squadron Leader G. F. Breese, D.S.C., is placed on half-pay list, scale A (Feb. 5); Flying Officer C. S. Horne relinquishes his short service commn. on account ill-health (Feb. 12); Lt. A. A. Murray, R.N., Flying Officer, R.A.F., ceases to be attached to R.A.F. on return to Naval duty (Feb. 3).

Stores Branch

Pilot Officer on probation R. G. Seymour is confirmed in rank and promoted to rank of Flying Officer (Jan. 10).

Medical Branch

A. H. Barzilay, M.B., Ch.B., is granted a short service commn. as Flying Officer for three years on active list with effect from and with seniority of Jan. 17 and is seconded for duty at Royal Southern Hospital, Liverpool.

Memorandum

The permission granted to 2nd Lieut. C. Fletcher to retain his rank is withdrawn on his enlistment in Supplementary Reserve (Jan. 20).

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Flight-Lieut. A. H. Dalton is granted a commn. in Class A (Jan. 17); Flying Officer C. C. Clark is confirmed in rank (Jan. 23); Flying Officer F. O. Burnley relinquishes his commn. on completion of service (Sept. 1, 1929).

Medical Branch

Flying Officer T. Glynn relinquishes his commn. on completion of service (Jan. 23).

AUXILIARY AIR FORCE

General Duties Branch

No. 600 (CITY OF LONDON) (BOMBER) SQUADRON.—The following Flying Officers to be Flight-Lieuts.:—G. W. H. Wallcousins (Dec. 15, 1929); W. R. Massey (Jan. 1); T. Courtis (Jan. 18). Flight-Lieut. A. H. Dalton resigns his commn. on appointment to Reserve of Air Force Officers (Jan. 17).

The following Flying Officers to be Flight-Lieuts.:—No. 601 (COUNTY OF LONDON) (BOMBER) SQUADRON.—H. N. St. V. Norman (Jan. 1). No. 602 CITY OF GLASGOW) (BOMBER) SQUADRON.—J. S. Lennox (Dec. 15, 1929); D. F. McIntyre (Jan. 1); D. Douglas-Hamilton, Marquess of Douglas and Clydesdale (Jan. 15). No. 603 (CITY OF EDINBURGH) (BOMBER) SQUADRON.—A. R. H. Miller (Dec. 15, 1929); J. M. Fosbrooke (Jan. 1); A. H. Bruce (Jan. 16). No. 605 (COUNTY OF WARWICK) (BOMBER) SQUADRON.—J. M. Leach (Dec. 15, 1929); C. L. Knox, V.C. (Jan. 1); G. V. Perry (Jan. 15).

London Gazette, February 18, 1930.

General Duties Branch

The follg. are granted short-service commns. as Pilot Officers on probation with effect from and with seniority of Feb. 3:—R. V. Alexander, N. H. Bantoft, J. Boston, H. M. Bowes-Lyon, H. F. Clayton-Daubeny, E. J. P. Davy, W. G. Eatherley, T. J. MacInerney, J. G. Mansfield, P. W. E. Ryland, R. M. Smith, J. B. T. Whitehead. The follg. are granted short-service commns. as Pilot Officers on probation, with seniority of Feb. 3, and with effect from the dates stated:—B. E. Lowe (Feb. 5); U. Y. Shannon (Feb. 11).

Lieut. E. T. Kingsford, P.W. Vols., is granted a temporary commn. as Flying Officer on being seconded for duty with the R.A.F. (Feb. 10); Pilot Officer on probation E. J. Finnegan is confirmed in rank (Jan. 6). The follg. Pilot Officers are promoted to the rank of Flying Officer:—M. V. Delap (March 10, 1929); J. Coverdale, K. G. Vandyck, F. K. Wood (Jan. 14); A. E. Dark, W. R. Worstall, C. B. Hughes, H. J. Pringle, J. W. Homer, R. D. Williams, C. Ryley, A. Wall, R. A. Sprague, F. P. Hewitt, J. G. Llewelyn (Jan. 28).

Group Captain A. B. Burdett, D.S.O., is placed on half-pay list, scale B, Feb. 4 to June 11, inclusive; Flight-Lieut. C. M. E. Gifford relinquishes his short-service commn. on completion of service (Feb. 15); Flying Officer D. I. Stewart relinquishes his short-service commn. on account of ill-health (Feb. 18). The short-service commn. of the follg. mentioned Pilot Officers on probation are terminated on cessation of duty:—W. E. M. Slocock (Feb. 11); R. G. Hosken, M. W. Simons, D. E. T. Whittlesea (Feb. 18).

Stores Branch

The follg. Flying Officers are granted permanent commns. in this rank with effect from Jan. 10, 1929, on completion of probationary service:—R. B. Fleming, C. H. W. Boldero, A. E. Haes, J. T. Riggs. Pilot Officer on probation A. J. Howell is confirmed in rank and promoted to rank of Flying Officer (Jan. 10).

Medical Branch

Flying Officer C. C. Fenton, M.B., B.S., B.Sc., resigns his short-service commn. (Feb. 3).

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Flying Officer on probation P. Bailey is confirmed in rank (Feb. 10). *Gazette* of Jan. 17 concerning Flying Officer R. P. D. Brailli is cancelled. The follg. Flying Officers relinquish their commns. on completion of service:—S. T. Tipper (Jan. 17), R. V. D. White (Jan. 18).

AUXILIARY AIR FORCE

General Duties Branch

No. 601 (COUNTY OF LONDON (BOMBER) SQUADRON.—The follg. Pilot Officer to be Flying Officer:—I. A. Murray (Jan. 17). No. 602 (CITY OF GLASGOW) (BOMBER) SQUADRON.—The follg. Pilot Officer to be Flying Officer:—D. H. Back (Nov. 21), 1929).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified:—

General Duties Branch

Squadron Leaders: A. G. Bishop, A.F.C., to Elec. and Wireless Sch., Cranwell, 7.1.30; P. Huskinson, M.C., to No. 41 Sqdn., Northolt, 1.2.30; R. S. Aitken, M.C., A.F.C., to No. 25 Sqdn., Hawkinge, 6.2.30.

Flight Lieutenants: R. Y. Eccles, to No. 8 Sqdn., Aden, 3.2.30; C. H. Scofield, to No. 4 Sqdn., S. Farnborough, 6.2.30; A. E. Beilby, to No. 36 Sqdn., Donibristle, 10.2.30; R. Jones, to No. 100 Sqdn., Bicester, 22.1.30; C. F. Steventon, to Sch. of Photography, S. Farnborough, 30.1.30; F. L. Hopps, A.F.C., to R.A.F. Depot, Uxbridge, 16.12.29; S. C. Strafford, D.F.C., to R.A.F. Depot, Uxbridge, 1.2.30; E. H. Richardson, to No. 35 Sqdn., Bircham Newton, 3.2.30; G. H. Mills, to Station H.Q., Bircham Newton, 3.2.30; C. W. Harrison, to No. 1 Flying Training Sch., Netheravon, 3.2.30; C. B. S. Spackman, D.F.C., to R.A.F. Depot, Uxbridge, 8.1.30.

Flying Officers: E. J. Hill, to No. 101 Sqdn., Andover, 3.2.30; C. H. V. Hayman, to No. 1 Stores Depot, Kidbrooke, 5.2.30; A. F. Lingard, to No. 8 Sqdn., Aden, 3.2.30.

Pilot Officers: E. G. Sharp, to No. 36 Sqdn., Donibristle, 10.2.30; C. W. Black, to No. 2 Armoured Car Coy., Middle East, 3.2.30; E. C. Durbin, to No. 2 Armoured Car Coy., Middle East, 19.1.30.

Stores Branch

Flying Officers: F. W. Felgate, to H.Q. Iraq Command, 5.12.29; J. E. R. Sowman, to No. 70 Sqdn., Iraq, 8.10.29; M. S. Shapcott, to No. 5 Sqdn., India, 12.1.30.

Accountant Branch

Flight Lieutenant: R. F. C. Metcalfe, to Station H.Q., Hornchurch, 4.2.30.

Medical Branch

Air Commodore: J. McIntyre, M.C., to R.A.F. Depot, Uxbridge, 27.1.30.

Squadron Leader R. S. Overton, to No. 22 Group H.Q., S. Farnborough, 28.2.30.

Flight Lieutenants: J. D'I. Rear, to Princess Mary's R.A.F. Hospital, Halton, 22.2.30; P. D. Barling, to Station H.Q., Hornchurch, 1.2.30; W. S. Stalker, to Station H.Q., Kenley, 1.2.30; O. P. O'Toole, to Station H.Q., Mount Batten, 28.1.30; J. B. Murphy, to R.A.F. Training Base, Leuchars, 3.3.30.

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IN PARLIAMENT

Municipal Aerodromes

THE UNDER-SECRETARY OF STATE FOR AIR (Mr. Montague) on February 12, in reply to Mr. T. Lewis said that five local authorities—Blackpool, Bristol, Hull, Manchester and Nottingham—have established municipal aerodromes. Six authorities—Carlisle, Ipswich, Liverpool, Plymouth, Sheffield and Stoke-on-Trent—have purchased land for aerodromes; 11 other authorities are negotiating for the purchase of suitable sites and five more have reserved sites in their town planning schemes. In addition, 76 authorities have shown that they are actively interested in the establishment of aerodromes, and of these, 38 authorities have had sites inspected.

Mr. Lewis asked Mr. Montague if any authorities are experiencing difficulty in regard to the purchase of land owing to heavy costs; and, if so, will he take steps in the matter?

Mr. Montague: That is a matter for the municipalities themselves, but I will take a note of the hon. Member's question.

Mr. Hardie: Is the hon. Gentleman aware that his Department is competing with municipalities who are trying to get land for housing schemes.

Mr. Montague: I am aware of the fact that in matters of this kind there are considerations of whether sites are suitable or not.

Maj. Sir Archibald Sinclair: Does not that question show the importance of getting these aerodromes established before the ground is required for housing?

Mr. Palmer: Is it the policy of the Ministry to assist municipalities in making these aerodromes?

Mr. Montague: The policy of the Air Ministry is to assist the municipalities, and they are doing it as effectively as possible.

Cross-Channel Services and Safety Regulations

MR. MONTAGUE, in reply to Capt. H. Balfour, said isolated complaints had occasionally been received from British pilots that on the French side the regulations with regard to the reporting of aircraft not equipped with wireless had not been fully carried out. The attention of the French air authorities is always called to complaints of this nature when they are brought to the notice of the Air Ministry.

Aviation, Fatal Accidents

MR. MONTAGUE, in reply to Mr. Wells, said according to Air Ministry records, there were six fatal accidents to British civil aircraft involving nine deaths in 1927, 13 such accidents involving 19 deaths in 1928, and 12 such accidents involving 33 deaths in 1929. The above figures cover all categories of civil flying, and only a very small proportion of the accidents (under 10 per cent.) occurred on regular air transport services.

R.A.F. Fatal Accidents

THERE were 40 fatal accidents involving 57 dealts in the Royal Air Force in 1927, 50 accidents involving 76 deaths in 1928, and 31 accidents involving 42 deaths in 1929.

Municipal Aerodromes

MR. T. LEWIS asked the Under-Secretary of State for Air whether he is aware of the difficulties experienced by local authorities with regard to the purchase of land for municipal air ports; and if he will consider the desirability of providing statutory powers for the compulsory acquisition of land required for the purpose of establishing municipal air ports.

Mr. Montague: I am aware that difficulties have arisen in certain cases. A general power to acquire land for aerodromes by agreement is, of course, conferred upon local authorities by Section 8 of the Air Navigation Act, 1920, and some municipalities have taken compulsory powers for this purpose in special Acts which they have promoted. Whether it will be possible to grant them such powers by means of any general legislation, I am not in a position to say, but the question is receiving consideration.

Airship R 100

MR. MONTAGUE, in reply to Capt. Balfour, said R 100 is not considered suitable for use in tropical climates while fitted with petrol engines, and her operations will consequently be confined at first to northern latitudes. It is not proposed to re-engine her for the present with compression ignition engines, as used in R 101, since these are still in the experimental stage.

Licensed Aerodromes

MR. EVERARD asked the Under-Secretary of State for Air the number of approved landing grounds for civil aircraft in Great Britain at the beginning of 1929 and 1930, respectively.

Mr. Montague, in reply to Mr. Everard, said the number of licensed aerodromes was 77 at the beginning of 1929 and 90 at the beginning of 1930. During the course of each year a large number of aerodromes are normally licensed for short periods, generally for joy-riding purposes; thus the total number of aerodrome licences issued in 1928 was 206, and in 1929 320, apart from renewals in each case.

Non-Stop Flight

Mr. Everard asked whether, with regard to the new attempt to be made for a record non-stop flight, this attempt will be made by a specially-built Royal Air Force machine; and the approximate cost of the machine.

Mr. Montague: No proposal to make a further attempt upon the long-distance flight record has yet been considered.

R.A.F. Enlistments

Mr. Montague, on February 17, in reply to Mr. Hore-Belisha, said 6,918 effective applications were received from men and boys for enlistment in the Royal Air Force during 1929. The numbers attested were 2,121 men and 1,194 boys.

Commercial Aviation Subsidies

Mr. Montague, on February 19, in reply to Mr. Wise, said the subsidies voted in respect of commercial aviation, or the carrying of air mails, by the following nations: the United Kingdom, the United States, Germany, France, and Italy were, in this country, Germany, France and Italy in respect of the financial year beginning at different dates in 1929, respectively £354,000, 10,550,000 reich marks (excluding financial assistance from local authorities), 172,300,000 francs and 56,500,000 lire. No comparable figure can be quoted for the United States of America, since financial assistance for this purpose is there given in the shape not of direct subsidies, but of mail contracts placed at higher rates than those recoverable from the public through air mail surcharges; the amount thus voted for payments to air mail contractors for the year beginning July 1, 1929, was $17,600,000.

Mr. Wise: *With regard to the German figures, could the figures be got* for the subsidies from the local authorities which, I think, are by far the biggest factor?

Mr. Montague: I agree that they are by far the biggest factor, but there is some difficulty in getting them.

University Air Squadrons

Sir P. Dawson asked the Under-Secretary of State for Air whether any steps are being taken to provide an air squadron for the University of London Officers' Training Corps in a similar manner to those already existing at Oxford and Cambridge; and, if any steps are being taken, how long it would be before the University of London Officers' Training Corps will be provided with an air squadron.

Mr. Montague: My noble friend regrets that financial considerations preclude any immediate addition to the number of University air squadrons, but he will further consider the proposal in due course.

Engine Exhaust Silencers

Mr. Montague, in reply to Mr. Maclean, said a number of engine exhaust silencers are under investigation at the Royal Aircraft Establishment, Farnborough. *All designs involve the carrying of considerable extra weight,* and no decision has yet been reached as to the design which achieves the best compromise between weight and efficient silencing.

De Havilland Aircraft of Canada, Ltd.

According to the first annual statement, covering 13 months, the De Havilland Aircraft of Canada, Ltd., earned trading profits, after providing for depreciation but before provision for Federal income tax in the period ended September 30, 1929, of $85,238. From this amount $7,500 was taken for discount on sale of shares, $297 for organisation expenses, $6,873 was reserved for Dominion income tax and $10,170 for dividends, and the balance carried forward was $60,067. With regard to depreciation, a full year's depreciation was allowed for new buildings and aerodrome, although they were actually taken over only in the final month. (All the buildings at the new aerodrome have now been completed and are fully paid for.) Certain non-recurring charges were also written off. A steady increase in the demand for new machines and parts was experienced throughout the period. The addition of the Hawk-Moth model should prove an increasing factor in earnings.

The balance sheet reveals the company in a secure working position. Current assets stood at $377,847, as against current liabilities of $77,334, making the net working capital $300,513. Cash totalled $114,842 and accounts receivable, less doubtful accounts, $69,594, with stocks on hand of $163,411. Fixed assets total $110,168, deferred charges $3,124, and manufacturing rights are booked at $1. On the liabilities side a mortgage payable appears of $21,400.

The company at its annual meeting declared an interim dividend of 25 cents per share on the class "A" stock.

Mr. R. A. Loader, general manager, in addressing the shareholders, expressed satisfaction at the results achieved. During the year 130 Moth aircraft were delivered, mostly of the new metal fuselage type, with the company's own "Gipsy" engine as a power plant. A considerable proportion were seaplanes, and 95 per cent. were fitted with Handley Page slot gear. Among the chief orders executed were 34 land 'planes for the Dominion Government and six seaplanes for the re-equipment of the Royal Canadian Air Force; a quantity of seaplanes for the civil government, equipped with radio communication, as well as 'planes for the Ontario Provincial Air Service, numerous clubs, for private use, and flying schools, operating concerns and prospecting companies. Use of 'planes for northern exploration was a notable development.

R.A.F. SPORT

Rugby Football

R.A.F. v. United Banks

The Royal Air Force XV beat United Banks at West Ealing on Wednesday, February 19, by 2 goals and a try (13 points) to a goal and a try (8 points). The match was most exciting, and the result came as a surprise to most of the spectators. The R.A.F. played without their two Irish internationals, Odbert (fly half), and G. R. Beamish (forward). Consequently P.O. J. G. Llewellyn moved from his usual place at centre three-quarter to fly half. In the first few minutes of the game his ankle was hurt and he was carried off the field. F.O. Pott came from the wing to take his place, and Sergt. Kirby was taken out of the pack to play on the wing. This upset the R.A.F. team, and in the first half they made only a poor show. The fly half of the Banks, Elvis, made an excellent dash for the line, and Taylor got the ball and scored. The goal was kicked. This was the only score in the first half. After the interval Llewellyn returned to the field, limping badly, but gradually recovered. The Banks scored another try through Edinborough, and all seemed over except the cheering. Then in the last quarter of an hour the Banks tired and cracked. The Air Force forwards kept going and romped over them. Llewellyn made an opening for Cotton to score under the posts. Llewellyn kicked the goal. Then P.O. White got away and passed inside to Pott who scored again, and again Llewellyn converted. This put the airmen ahead. Finally, from a scrum near the Banks' line, P.O. Elsmie slipped over in the right corner and made assurance doubly sure. The R.A.F. were easily masters of the game when the whistle went for time. The teams were:—

United Banks.—H. E. Goldsmith, back; N. R. Gillett, J. W. Perts, S. E. P. Edinborough and F. J. Hodges, three-quarter backs; R. L. Elvis and J. E. Taylor, half-backs; W. H. Glock, H. W. Gilbert, R. S. Osborne, M. B. Helder, C. Featherby, K. A. MacNab, I. C. MacLennan, and L. G. Butt, forwards.

R.A.F.—Pilot Officer G. M. Ievers (Digby), back; Pilot Officer White (Digby), Corporal Clements (Shrewsbury), Flying Officer J. R. H. Pott (Grantham), and Flying Officer R. D. Cotton (Duxford), three-quarter backs; Pilot Officer J. G. Llewellyn (Worthydown) and Pilot Officer Elsmie (Tangmere), half-backs; Pilot Officer J. McKechnie (Calshot), Corporal King (Shrewsbury), Sergt. Kirby (Halton), Pilot Officer H. A. Constantine (Cranwell), Flying Officer Beaumont (Farnborough), Sergt. Hall (Wittering), Leading Aircraftsman Maxwell (Duxford), and Pilot Officer A. C. Wallace (Upavon), forwards.

Hockey

R.A.F. v. Middlesex

The Royal Air Force Hockey XI beat Middlesex county at Hillingdon, Uxbridge, on Wednesday, February 19, by 1 goal to nil. The goal was scored by Leading A./C. Connell towards the end of the second half. The R.A.F. defence was very sound and was, perhaps, the outstanding feature of the game. The teams were:—

R.A.F.—Corporal C. Butler (Stanmore); Corporal Foreman (Sealand) and Flying Officer W. K. Beisiegel (Donibristle); Leading A./C. L. R. Hobbs (Uxbridge), Sergt. W. C. Maher (Upavon), and Leading A./C. Lodge (Worthydown); Flying Officer N. M. Jerran (Halton), Pilot Officer D. P. Lascelles (Tangmere), Leading A./C. F. Connell (Gosport), Flying Officer S. C. Button (Bicester), and Flight-Lieut. H. N. Hampton (Digby) (captain).

Middlesex.—H. L. Hodgkinson; C. L. Mason and H. E. Nash; C. A. Sutcliffe, J. W. H. Tyrrell and R. L. Milstead; E. W. Holman, R. W. Tydd-Chapman (captain), O. L. Bateson, C. S. Petheram and R. T. Read.

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1930 *Star Cars*.—The Jason Series. The Star Motor Co., Ltd., Wolverhampton.

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AERONAUTICAL PATENT SPECIFICATIONS

***Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motor.**
(The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

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